Out of This World: Dutch Astronomical Books in Tokugawa Japan

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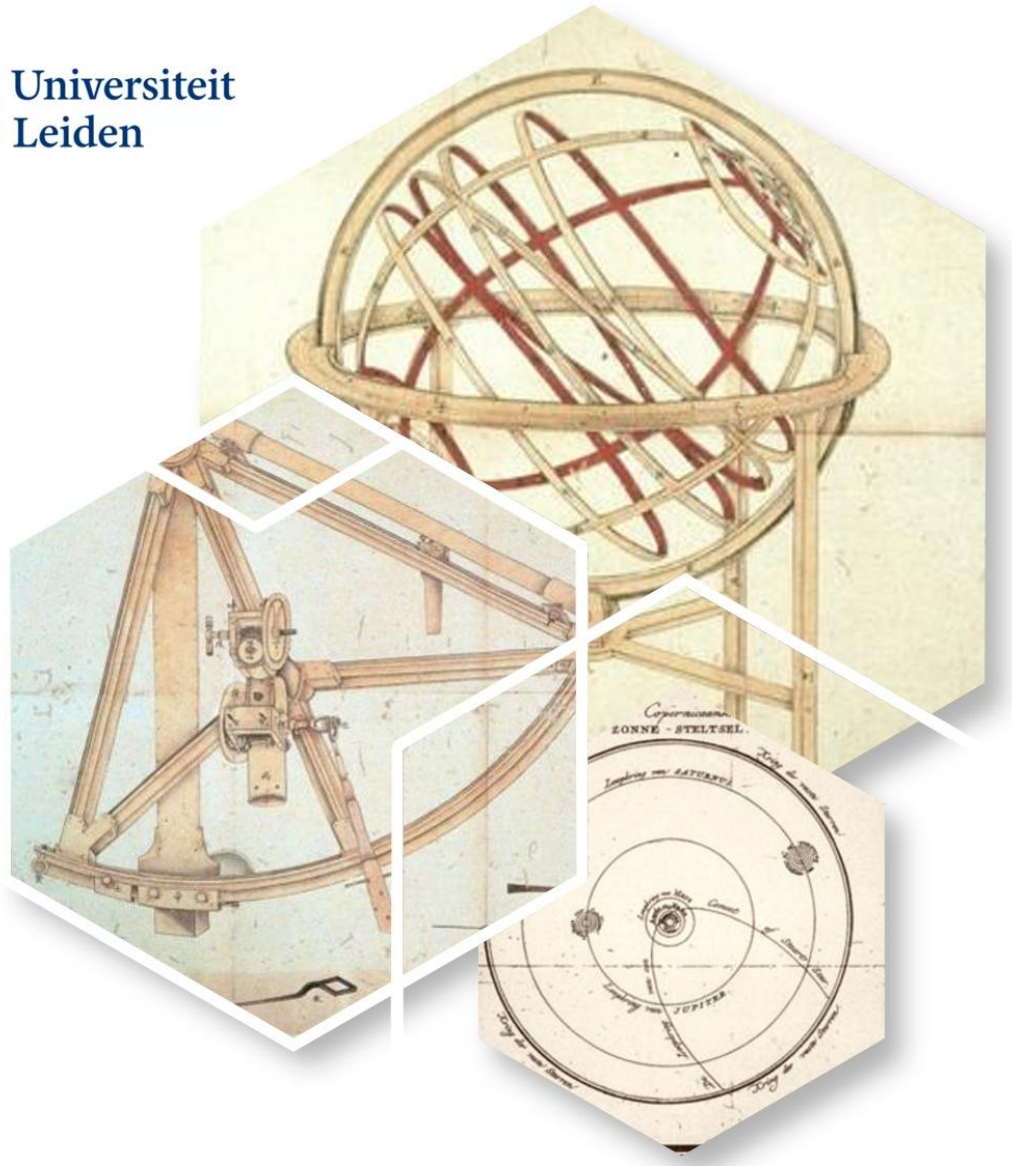

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Dutch Astronomical Books in Tokugawa Japan

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s1665901
Master Thesis
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First reader: Prof. dr. P.G. Hoftijzer
Second reader: dr. A. Dlabačová
28 May 2021 Word count: 20.186

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Chapter 1

Introduction

> "The Dutch have the excellent national characteristic of investigating matters with great patience until they can get to the very bottom ... Their findings, which are the result of the efforts of hundreds of people studying scientific problems for a thousand or even two thousand years, have been incorporated in books which have been presented to Japan." — Hirata Atsutane (1776-1843)[1]

1.1 Dutch books in Tokugawa Japan

Dutch scientific books have found their way to Japan in a peculiar way. It all started with the special relationship Japan and the Netherlands have built since the year 1600. During the Tokugawa period (1603-1867) this relationship centred around the trade between the Japanese *shogun* and the Dutch East India Company (Vereenigde Oostindische Compagnie, or VOC for short).[2] However, the Japanese were not only interested in the goods the VOC brought with them to trade. They were also very much interested in the Dutch themselves, their customs, culture, science and even the weather they lived in. The *shogun* himself, as well as official interpreters and scholars asked the VOC-personnel, often much to their annoyance, questions on everything foreign.[3] Slowly, throughout the years of trading between the Dutch and Japanese, VOC-officials began to bring Dutch books with them to Deshima, the island in the bay of Nagasaki where the Dutchmen lived during their stay in Japan. These books found their way all over Japan by trading, lending, and translation.[4]

Dutch books became an important part of the intellectual movement called *rangaku*. As the Dutch were the only Europeans allowed in Japan during the larger part of the Tokugawa

[1] S. L. Montgomery, *Science in Translation: Movements of Knowledge through Cultures and Time* (Chicago: University of Chicago Press, 2000), p. 214.
[2] Y. Suzuki, *Japan-Netherlands Trade 1600-1800: The Dutch East India Company and Beyond,* (Kyoto/Melbourne: Kyoto University Press/Trans Pacific Press, 2012), p. xi.
[3] C. Viallé, "Zingen voor de shogun: VOC-dienaren aan het Japanse Hof," in L. Wagenaar (ed.), *Aan de overkant* (Leiden: Sidestone Press, 2015), p. 36.
[4] T. Jackson, *Network of Knowledge: Western Science and the Tokugawa Information Revolution* (Honolulu: University of Hawai'i Press, 2016), p. 123.

period, the term literally translates to "Dutch studies" or "Dutch learning", but was not limited to the study of Dutch science and sources. *Rangaku* scholars were not only interested in the Netherlands and the Dutch language, but in Western science in general.[5] The *rangaku* movement was split in two main disciplines: medicine and astronomy. The study of medicine as a rule consisted of botany, pharmacopoeia, mineralogy, chemistry, physics, and zoology. The study of astronomy included surveying, cartography, and geography.[6] These two main areas reflect the interests of the Tokugawa shogunate, the official government of Japan in the seventeenth, eighteenth and nineteenth centuries. The shogunate was interested in medicine to prolong Japanese lives and astronomy to improve the calendar and with that, the agricultural cycle.[7]

Research on medicine in Tokugawa Japan has already pointed out the impact of Dutch books during this period.[8] However, Dutch books also played an important role in the introduction of western astronomy in Japan. Theories such as those of Copernicus and Newton found their way to Japan via Dutch books, or Dutch translations of English and French originals. This thesis will therefore focus on Dutch books in relation to the study of astronomy in Tokugawa Japan. Various subjects will be touched upon, such as Japanese-Dutch relations, scholarship and astronomy in Japan, *rangaku,* the Tokugawa government, and, most importantly, the import, translation and spread of Dutch books. These subjects are interesting for both historians of Japan and book historians in general, as will be explained in a later paragraph.

[5] G.K. Goodman, *Japan and the Dutch: 1600-1853* (Richmond, Surrey: Curzon, 2000), p. 6.
[6] Ibid.
[7] Ibid.
[8] See for example W.F. Van de Walle and K. Kasaya, *Dodonaeus in Japan: Translation and the Scientific Mind in the Tokugawa Period* (Leuven /Kyoto: Leuven University Press/International Research Center for Japanese Studies, 2001).

1.2 The Influence of Dutch Books on Japanese Astronomy

As the quote from the Japanese scholar Hirata Atsutane (1776-1843) at the beginning of this chapter suggests, Dutch books were of great interest to Japanese scholars during the Tokugawa period. Even those who were very patriotic and renounced everything which was foreign, like Hirata himself, did acknowledge the attraction of Western scientific knowledge and the Dutch books that brought this knowledge to Japan.[9] So how did these books come to Japan? What happened with the Dutch books when they came into the hands of the Japanese? And did these books influence Japanese scholars and Japanese science in any way? These are the kinds of questions which will be answered in this study.

The main focus of the research is the influence of Dutch books on the study of astronomy in Japan. This thesis aims to investigate the exchange and usage of Dutch books by Japanese scholars and officials who were connected to the study of astronomy. Subjects such as the acquisition, translation, and spread of particular Dutch titles will be discussed. Certain important figures in the history of astronomy in Japan will be discussed as well, with special attention for the books and manuscripts they produced with the help of books from the Netherlands. Their works will highlight the influence of the Dutch originals and their importance for astronomy in Japan.

1.3 Why Study Dutch Books in Japan?

Book historians have done extensive research on books and printing during certain periods and within certain regions. Especially the shift from manuscript to printing in Europe has received much attention. Other European developments which were directly related to print culture have been studied by numerous scholars throughout the world. When it comes to the seventeenth century, the Netherlands is also incorporated in these studies, as it was an important centre of book production. The Netherlands enjoyed a great amount of freedom when it came to printing, which made places such as Amsterdam a printing paradise.[10] Often, however, Dutch book historical research is confined to the borders of Europe. But when we look at Hirata Atsutane's quote, it

[9] Montgomery, *Science in Translation*, p. 214.
[10] P.G. Hoftijzer, "The Dutch Republic, Centre of the European Book Trade in the 17th Century", *European History Online (EGO)* (Mainz: Leibniz Institute of European History, 2015) <http://ieg-ego.eu/en/threads/backgrounds/the-book-market/paul-g-hoftijzer-the-dutch-republic-centre-of-the-european-book-trade-in-the-17th-century>(9 September 2020), p. 9.

appears that Dutch books had an influence in other parts of the world as well. Because of its colonialism and world trade, the Netherlands has a rich book history outside of Europe.

This thesis is an attempt to discuss this particular area of book history. However, the thesis does not centre on Dutch printing, or the Dutch book trade, but on the Japan-Dutch relations that made the spread of Dutch books in Japan possible and the impact of Dutch books in Japan. It is, moreover, important to not apply a fixed European perspective on this exchange, but also to consider Japanese sources. This thesis aims to combine both Japanese and Dutch sources in order to discuss the relation between the two countries during the Tokugawa period. This is an important aspect of the research, as Japanese-Dutch relations are not often discussed in Dutch history. For sure, those who studied Japan have given sporadic attention to the Japanese-Dutch relations, but in general these relations appear to be quite unknown to the Dutch. Therefore, this thesis will not only have book historical significance, but also touches upon the sociology of Japanese and Dutch exchange within the unique context of the VOC, Japanese scholarship and government, and the exchange of scientific knowledge through books. These relations are analyzed through the lense of social exchange theories (see section 1.5).

Lastly, it is important to learn more about the use of books, printing, and scholarship in other parts of the world in order to reflect upon the often argued uniqueness and superiority of European culture. For this reason, eurocentrism plays a role in the conclusion of this research, as it is believed it is important to be subjective when drawing conclusions on the impact of European countries on those outside of Europe (see section 1.5).

1.4 Primary Materials and Important Figures

This research is not focused on merely discussing the general history of books in the Netherlands and Japan. In an attempt to give a more detailed explanation of the influence of Dutch books in Tokugawa Japan, examples of Dutch and Japanese books are given together with their users and creators. First, primary materials were selected to support the historical background and arguments given. These materials consist of Japanese and Dutch books, manuscripts, archival documents, letters, and drawings. Of particular interest were the demands made by the Japanese *opperburgermeester* (mayor), *gouverneur* (governor), *landheer* (landlord), and *Zijn Kijzerlijk Majesteit* (His Imperial Majesty)[11]. These Dutch terms referred to the Japanese *daimyo* (lords),

[11] Het Geheugen, "Japanse eisen", <https://geheugen.delpher.nl/nl/geheugen/pages/collectie/Japanse+eisen> (14 October 2020).

Nagasaki officials, scholars, and the shogun. Within these demands, lists of goods Japanese requested from the Dutch VOC-officials can be found, objects, ranging from scientific instruments and books to tableware and minerals. These documents were written and signed by a VOC-official and in most cases their *opperhoofd* (chief). Sometimes books are listed by title, indicating which books were regarded as important by the Japanese.

When it comes to the records of the trade between the Japanese and the Dutch at Nagasaki, such as the demands described above, the focus will be on those in Dutch. As Louis Cullen describes in his article "The Nagasaki Trade of the Tokugawa Era: Archives, Statistics, and Management", Japanese records are not preserved well. Nagasaki officials often took documents with them after retirement, while archival material often did not survive during a transfer to the shogun's capital Edo. The Nagasaki trade records were maintained well until 1868, when the archival material was lost almost completely.[12] For this reason, Dutch documents on the Nagasaki trade are used as primary material in this research.

Other primary materials used include Dutch books and Japanese manuscripts. A few titles have been selected. The Dutch books from the seventeenth to end of the eighteenth century were selected because they served as source material for the works of important Japanese scholars who wrote on astronomy. These Japanese works are investigated as well. The books were also used to compare the astronomical and mathematical diagrams which could indicate direct influence from Dutch books on Japanese translations and as well as on original works.[13]

Lastly, in order to present an account of the use of Dutch books in the study of astronomy in the Tokugawa period, a few important Japanese scholars have been selected. Their scholarly work or other influence on the acquisition, translation and spread of western astronomy within Dutch books will be discussed in the third chapter. These scholars are Motoki Ryōei, Shimazu Shigehide, Shiba Kōkan, Shizuki Tadao, and Yoshio Nanko. Motoki Ryōei (本木享永, 1735-1794) was a well known Nagasaki interpreter who made influential translations of Dutch books on astronomy.[14] Shimazu Shigehide (島津重豪, 1745-1833) was lord of Satsuma between 1755 and 1787 and is

[12] L. Cullen, "The Nagasaki Trade of the Tokugawa Era: Archives, Statistics, and Management", *Japan Review,* 31 (2017), pp. 69-72.
[13] The primary material comes from Japanese archives, the Dutch National Archive or the library of Leiden University. Most materials are digital scans of the originals. The demands described above are digital scans accessed from "Het Geheugen", a website by Delpher with the collection from the National Archive. Manuscripts and drawings come from the Leiden University Libraries Digital Collections. Lastly, the images of the manuscript used in this thesis come from the Waseda University Library.
[14] Goodman, *Japan and the Dutch,* pp. 98-101.

mentioned in the Japanese demands, where he requested books for his personal collection.[15] He also maintained contacts with important Dutch figures and had a great impact on Japanese scholarship by establishing schools, medicinal gardens, and an observatory.[16] Shiba Kōkan (司馬江漢, 1747-1818) is a famous painter who learned Dutch techniques. However, he was also a scholar and is known as the popularizer of Copernican theories in Tokugawa Japan.[17] Another famous figure is Shizuki Tadao (志筑忠雄, 1760-1806), who wrote important works on several subjects, among them astronomy and the theory of Copernicus, based on Dutch books.[18] Yoshio Nanko (吉雄南皐, 1787-1843) was a disciple of Shizuki Tadao and a translator, physician and teacher of science.[19] The works, activities and relations of these scholars will be discussed to prove, or disprove, the assumed influence of these men and of the Dutch books they used.

1.5 Technology, Culture, Power and Exchange

Since a comparison between the Netherlands and Japan is inevitable when researching this subject, it is useful to review and apply concepts such as ethnocentricity, and its varieties eurocentrism and orientalism. It is also important to review, compare and contrast the secondary literature which has already been written on the subject in order to gain a better understanding of the different perspectives and attitudes towards the subject. This section will then provide an explanation of the (sociological) theories applied throughout the thesis and will paint a picture of the scholarly debate on the influence of Dutch books on science in Tokugawa Japan.

1.5.1 Sociological Theory on Technology, Culture, Power and Exchange

The Theft of History: ethnocentricity, eurocentricity and orientalism

In his book *The Theft of History* (2006) Sir Jack Goody argues world history has been influenced by western scholars and their ethnocentric perspectives. Goody was an important anthropologist who wrote many books on themes such as kinship and marriage, orality, writing and transmission, technology, and eurocentrism. *The Theft of History* is one of his works on eurocentrism, in which

[15] JapanKnowledge, "島津重豪", <https://japanknowledge-com.ezproxy.leidenuniv.nl:2443/lib/en/display/?kw=%E5%B3%B6%E6%B4%A5%E9%87%8D%E8%B1%AA&lid=1001000110796> (9 September 2020).
[16] Goodman, *Japan and the Dutch,* pp. 157-158.
[17] JapanKnowledge, "しば-こうかん 【司馬江漢】", <https://japanknowledge-com.ezproxy.leidenuniv.nl:2443/lib/en/display/?kw=%E5%8F%B8%E9%A6%AC+%E6%B1%9F%E6%BC%A2&lid=200201f0f2aevRpEd8i6> (9 September 2020).
[18] Ibid.
[19] Goodman, *Japan and the Dutch,* pp. 161-162.

he argues western scholars have claimed many concepts and successes as unique to Europe, explaining these inventions as results of the development during the Antiquity and Renaissance. He then argues these claims should be met with critique, as ethnocentricity, eurocentricity and orientalism have influenced European historiographical discourse.

When writing about other parts of the world, it is important to be aware of how European scholars have conceptualized and presented the past under the influence of events in Europe alone. Next, they have projected these historical events upon other regions in the world, which has led to accounts of, for example, Asian history where there is a large contrast between Asia and Europe and a clear favour for the latter.[20]

Next to this, scientific and political developments and concepts are often credited to be of European origin. For example, democracy and feudalism are commonly thought to be European "inventions", originating from the ancient Greeks. However, as Goody shows, these concepts can often be found in other regions throughout the world as well.[21] With regard to science, China and the Middle East were more developed than Europe during certain periods and European science could not have developed so far and fast without the works of scholars from those regions. European astronomy, as it came to Japan during the Tokugawa period, was highly influenced by Middle Eastern works.[22] It is therefore important to realize the history of science and development as presented to and by European scholars is often biased by ethnocentric perspectives and incomplete due to the lack of information on non-European regions.

Goody also notes that ethnocentrism is, again, not a European invention.[23] As can be seen from accounts of different countries on other newly discovered nations, every person throughout history has suffered from an ethnocentric perspective, often deeming the 'Other' as barbarian and backwards. Arguments such as these were taken into account during two stages of this research. First, while analyzing the secondary literature on the exchange between the Dutch VOC-personnel and the Japanese scholars and second, while drawing conclusions from this current study. For example, the notion that Japan's modern science and even its modernization as a whole could be credited to the Netherlands and the Dutch who brought over scientific books and ideas, as some scholars have argued, is very similar to the eurocentric ideas that are refuted by Goody in *The Theft*

[20] J. Goody, *The Theft of History* (Cambridge: Cambridge University Press, 2007), p. 5.
[21] Ibid., pp. 37, 66-67.
[22] Ibid., p. 21.
[23] Ibid., p. 5.

of History. The secondary literature used for this research was read critically, keeping in mind the tendency towards eurocentric perspectives.

Second, the theory of eurocentrism plays a part in the conclusion of this research. As mentioned before, this thesis aims to discuss the influence of Dutch books (and the Dutch officials that brought them to Japan). It is easy for a Dutch researcher to fall into the trap of eurocentric views and conclude that the influence of the Dutch and their books was indispensable in Japan's journey towards modernity. Therefore, this study has taken into account the larger history behind the science of astronomy and the Japanese shift towards modernity. As will be clear from further chapters, the role of the Dutch is not to be undermined. However, it is also important to be critical and to take into account the role of the Portugeuse, the Chinese, and the Japanese themselves in the development of Japanese astronomy.

Exchange theory and network exchange theory

The second chapter of this thesis deals with the history of the Dutch in Japan, *rangaku,* and astronomy in Japan. In order to paint a picture of the exchange between the Dutch and Japanese with regard to western scientific knowledge, it is also useful to apply theories such as network exchange theory. The work of scholars such as Peter Blau and Karen Cook can give us insight into the opportunities and limits of relationships and exchange as those existing between the early modern Netherlands and Japan.

Peter M. Blau (1918-2002) was a distinguished professor at Columbia, Pitt professor at Cambridge University and honorary professor at Tianjin Academy of Social Sciences. He researched social exchange on a macro level, which led to his exchange theory that included the behaviour of organizations.[24] According to Blau social exchange is the most concentrated form of human interaction and is the core element in relations between individuals and groups. He further notes that social exchange is always done through interaction, while focussing on specific goals. The exchange is done by interacting with other persons where both parties can use the exchange to further achieve their own goals.[25]

George Homans, founder of behavioral sociology and scholar on social exchange theory, argues organisations do not have a sociological character and social exchange as described here is

[24] "Peter Michael Blau", ASA: American Sociological Association, <https://www.asanet.org/about/governance-and-leadership/council/presidents/peter-m-blau> (9 January 2021).
[25] M. Dillon, "Chapter 7: Exchange, Exchange Network, and Rational Choice Theories," in *Introduction to Sociological Theory* (Hoboken: John Wiley & Sons, 2019), p. 246.

only occurring between individuals.[26] He argues social action and interaction are driven by the individual, his or her experiences and anticipation of reward and punishment. Next to this, social exchange is characterized by power imbalances, which leads to one person getting more out of the interaction than the other.[27] Despite these power imbalances, individuals are still willing to participate in social exchange as "one never gets [or gives] something for nothing".[28]

Homans' work on social exchange is focussed entirely at individuals and their psychological characteristics. This would mean social exchange can only be analyzed on an individual level as the psychological characteristics of each party could determine the interaction. However, as apparent from Blau's studies on social exchange and organisations, individuals also experience social exchanges which are influenced by (or occurring because of) characteristics which are linked to organizations, such as occupational rank and status among workers.[29] In this research, exchange theory is seen as a tool to understand the social dynamics between both individuals and groups, namely the Dutch and Japanese, who interacted with each other during the Tokugawa period. These interactions were often between two individuals, but those individuals almost always represented a larger organisation, be it the VOC or the *bakufu*. Therefore, this research prefers Blau's theory on social exchange.

To analyze the dynamics of the network where knowledge is exchanged, the network exchange theory is used. Sociologists Emerson, Cook and Whitmeyer have written on exchange networks and the power imbalance of relations. Richard Emerson (1925-1982) was a prize-winning sociologist, who developed theories on communication networks and did sociological fieldwork while climbing Mount Everest.[30] Emerson built upon the social exchange theory of George Homans (1910-1989) which deals with the exchange between two individuals, making it applicable to larger social units.[31] Karen Cook is a professor of sociology who in her research focuses on the importance of trust within social networks. Her theoretical work will be considered when analyzing the development of the relationship between the Dutch VOC and Tokugawa *bakufu*.[32] Joseph Whitmeyer focuses on immigration and population at the sociology department of UNC

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[26] Dillon, "Chapter 7: Exchange, Exchange Network, and Rational Choice Theories" p. 247.
[27] Ibid., p. 248.
[28] G.C. Homans, "Fundamental Social Processes," in Neil Smelser (ed.), *Sociology: An Introduction* (New York: John Wiley & Sons, 1967), p. 73, as quoted in Dillon, *Introduction to Sociological Theory*, p. 249.
[29] Dillon, "Chapter 7: Exchange, Exchange Network, and Rational Choice Theories", p. 249.
[30] Ibid., p. 238.
[31] Ibid.
[32] "Karen Cook", Stanford Sociology School of Humanities & Sciences, <https://sociology.stanford.edu/people/karen-cook> (9 January 2021).

Charlotte. He uses different kinds of models (e.g. spatial and network models) to research population, but also social exchange networks.[33]

According to Cook and Whitmeyer, the exchange network consists of linked actors which are connected through exchange, either directly or indirectly. They stress the power imbalances within this network, which make the exchange relations either positive or negative. For example, the one who has the most power in a relationship often enjoys a greater benefit from the exchange. [34] Some scholars argue the other party would in this case experience the exchange as a negative one. Therefore, trust is a necessary component of social relations to counter the negative impact of power imbalance, so both parties experience the exchange as positive. However, Cook argues trust is not a necessity for a network to function smoothly. According to her trust is helpful when initiating contact socially, but not necessary. Even in the absence of trust, people are willing to do things for each other, because of other assurances such as a concern about reputation, financial reasons, or because they are legally required to do so. This illustrates the importance of social capital, as having social contacts with those who are willing to do things for you is crucial for exchange within a network.[35]

Chapter Two will consider whether or not the relations between individuals and the network of Dutch VOC-personnel and Japanese scholars can be described as positive, negative, having strong or weak ties and what the possible influence was of the type of exchange that took place. In any case, these theories offer models for exchanges between individuals, organizations, and even countries as will be clear from this research. Of course, the main concern of this thesis is describing the influence of Dutch books. However, as will become apparent in later chapters, the books are tied to their authors, publishers and readers and the social network through which these books spread from the Netherlands to Japan was crucial for the further development of Japanese science.

1.5.2 Literature on the West and its Influence on Science in Japan

Within different disciplines, scholars have written on the Dutch influence on Japanese science and scholars. From the perspective of the history of science, Nakayama Shigeru has written several papers on the history of Japanese science and the influence of Portugese jesuits and Dutch

[33] "Joseph WHITMEYER", ResearchGate, <https://www.researchgate.net/profile/Joseph-Whitmeyer> (29 March 2021).
[34] Dillon, "Chapter 7: Exchange, Exchange Network, and Rational Choice Theories", p. 253.
[35] Ibid., pp. 254-256.

VOC-officials.[36] In his article "Abhorrence of 'God' in the Introduction of Copernicanism into Japan", Nakayama compares *Oranda chikyu zusetsu* (Dutch Illustrated Treatise on the Earth) by Motoki Ryōei to the French and translated works of Louis Renard, a publisher in Amsterdam during the early 1700s. Nakayama uses the comparison to support his earlier work on the introduction of the heliocentric system into Japan, where he describes the history of astronomy in Japan using primary and secondary Japanese sources. In his article Nakayama argues the Japanese translations of Dutch books were highly influential for Japanese astronomy, but he does not seem to hold the Dutch and their books in the same high regard.

In *Japan and the Dutch 1600-1853* (2000) Grant Goodman gives one of the most elaborate histories of the Dutch in Japan during the Tokugawa period in English. Similar to Nakayama, Goodman mentions many books written in Dutch, German, French and Japanese when discussing *rangaku* and the Japanese scholars from this field. However, Goodman rarely does this well. From a book historical perspective, *Japan and the Dutch*, in contrast to Nakayama, is lacking crucial information on book titles, authors, translators, publishers and the moment of publishing.

Other scholars are not necessarily focussed on history alone. In his book *Network of Knowledge: Western Science and the Tokugawa Information Revolution* (2016) Terrence Jackson discusses how a network of knowledge from Nagasaki to Edo was used by Japanese scholars to obtain information on western science. Applying a more sociological approach than Nakayama, he writes on *rangaku* and focuses especially on medicine, as his key figure was Ōtsuki Gentaku (大槻玄沢, 1757-1827), an important Japanese scholar of medicine. Jackson elaborately discusses the importance of the relations among Japanese scholars which, he concludes, aided the spread of western books and knowledge throughout Japan.

In response to the lack of book historical perspectives in the work of Goodman and Jackson, the primary sources used in this thesis will be presented through both text and picture, and the references will contain as much information as possible. As Nakayama has already researched the content of the books, it is not necessary to do that again here. Therefore, the focus lies more on the diagrams of the books and the journey the books travelled in the hands of Dutch sailors, and Japanese officials, *daimyo* (landholding military lords), and scholars. In order to add to the scholarly works already written on this subject, this research combines both (book) historical research and sociology, by combining the study of primary sources in online archives and libraries

[36] S. Nakayama, "On the Introduction of the Heliocentric System into Japan," in *The Orientation of Science and Technology: A Japanese View* (Folkestone: Global Oriental, 2009), pp. 4-17.

with sociological research on the key figures and their network in Tokugawa Japan. Next to this, an important goal of this research is to remain as objective as possible on the amount of influence the Dutch had on Japanese science and modernization.

According to historian Marius B. Jansen in his article "Rangaku and Westernization", there are Japanese and western scholars who have researched Japanese scholarship, westernization and politics and have concluded that the Dutch made the modernization of Japan during the Meiji period possible by importing western books and thereby distributing western knowledge.[37] Jansen, however, gives a more nuanced argumentation on why *rangaku,* and therefore the Dutch, influenced the modernization of Japan. The import of books, the written word, and political stances of Japanese scholars are briefly discussed. As a possible answer to the question "What, then, can one propose as the principal significance of *rangaku* and its continuities with modern Japan?" Jansen proposes "the attitude and mind-set" of *rangaku* scholars.[38] He then concludes *rangaku,* the Dutch and their language served as bridges from the Tokugawa period (or the middle ages) to the Meiji period (modernization).[39] However, one should remain critical and ask: What if it were the remaining Portugese Jesuits in Japan who spread western knowledge? What was so significant about the Netherlands? To what extent did the Dutch influence Japan? And are these aforementioned scholars biased because of eurocentrism? The answers to these questions will be discussed in the next chapter.

[37] M.B. Jansen, "Rangaku and Westernization", *Modern Asian Studies*, 18, no. 4 (1984), p. 541.
[38] Ibid., p. 549.
[39] Ibid., p. 553.

Chapter 2

The VOC and *Rangaku*

In this chapter the history of the exchange between the Dutch and Japanese will be discussed in the context of the VOC, *rangaku* and Japanese (astronomical) scholarship. From this chapter it will be apparent that the history of early modern science in Japan, and above all *rangaku*, is a history of social exchange, translation, and books. To understand how the study of astronomy was influenced by Dutch books, it is important to understand the social exchange between the Japanese and Dutch during the Tokugawa period, the development of Japanese modern science, and the introduction of astronomy in Japan through western books and their translation.

2.1 Japanese-Dutch relations during the Tokugawa period

During the period between the years 1600 and 1853, Dutch-Japanese relations were built up, developed into a strong economical and cultural bond and eventually weakened again. In many ways, both countries benefited from their unique relationship during the Tokugawa period. Next to trading goods, the two countries also exchanged knowledge on science, culture and history, which was very interesting for scholars and those interested in foreign lands. The characteristics of both countries, the motivations of the *bakufu* (the Japanese government) and VOC, and the differences between culture and science contributed greatly to the effectiveness of the interactions between the two countries, including the exchange of books and knowledge on astronomy.

2.1.1 Politics and Relations

Tokugawa Bakufu

The Tokugawa or Edo period in Japan lasted from 1603 to 1868. During this period, the country was governed by the Tokugawa family based in Edo (modern day Tokyo), where the *shogun* held the highest position. The emperor was seen as an important figure for the Japanese, but in reality he did not hold much power over the country. It was the *shogun* and his *daimyo* who dictated life in Japan. The Tokugawa period is known for its social, economic and cultural development. Tokugawa Japan is often referred to as early modern Japan by scholars, because of these

developments which would eventually lead to modernization in the Meiji period (1868-1912).[40]

After the battle of Sekigahara (1600), Tokugawa Ieyasu (徳川家康, 1543-1616) was able to abolish the military houses of the clans who were opposed to him. He confiscated their holdings and distributed the land among the *daimyo* who had fought next to him in the war, moving them around to further establish his power.[41] Of course, it took several years for the new shogunate, or *bakufu,* to establish its control. In order to be sure the lords all over Japan would not oppose the *shogun*, the *bakufu* took measures to limit the power of the *daimyo* and demand their loyalty. There were rules and regulations the lords had to follow. For example, the alternate attendance system (*sankin kōtai*) stated that the children and wives of the *daimyo* were required to live in Edo, as hostages, to make sure the lords would behave.[42] Next to this, the *daimyo* could be ordered to serve the shogun. If so, they had to leave their domain to stay in Edo for one year. The lords often brought companions with them to Edo, such as scholars from their domain.[43]

During the Tokugawa period, the government and *daimyo* gained interest in scholarship and foreign relations. Other developments made these interests possible to pursue. For example, the Tokugawa period saw a rise in the productivity of Japan's agriculture which led to an improved economy.[44] The wealth acquired by the lords was invested in research and travels to important cities in order to meet with Dutchmen and Japanese scholars. Next to this, the *bakufu* installed a well organised administrative system which led to the employment of officials, among whom scholars and translators.[45]

The Netherlands

Meanwhile, on the other side of the world, the Netherlands flourished in its own way. Similar to Tokugawa Japan, the Netherlands was a young state which was only recognized internationally as an independent country in 1648.[46] During the seventeenth century the Netherlands was very successful at producing books. One could argue that Holland, and in particular Amsterdam, was the centre of book trade in Europe in that period. Several factors played a part in the success of the Dutch book trade, such as the political situation, social and demographic conditions, the economic

[40] C. Nakane and S. Ōishi, *Tokugawa Japan: The Social and Economic Antecedents of Modern Japan,* translated by C. Totman (Tokyo: University of Tokyo Press, 1991), p. 11.
[41] Ibid., p. 22.
[42] C.N. Vaporis, "To Edo and Back: Alternate Attendance and Japanese Culture in the Early Modern Period", *The Journal of Japanese Studies*, 23 no. 1 (1997), p. 25.
[43] Ibid., p. 32
[44] Nakane and Ōishi, *Tokugawa Japan,* p. 3.
[45] Ibid., p. 3.
[46] Hoftijzer, "The Netherlands", p. 1.

situation, and religious, cultural and intellectual influences.[47] Firstly, the central government was weak in the Netherlands. The Dutch Republic was a union of seven independent provinces, which did not transfer their authority entirely to the central government, meaning the central government did not hold much power over the larger and wealthier provinces and cities. Amsterdam, the richest city of the country, was almost an independent city state, which contributed to its success as a centre for the book trade.[48]

Second, substantial waves of immigrants from all over Europe came to the Netherlands during the seventeenth century. These immigrants brought with them knowledge and experience in trade and industry which stimulated the economy. Another stimulus for the economy was the maritime trade of the Dutch, such as that of the VOC. Due to their successes in overseas trade and commercial expansion, the Netherlands became an important centre for trade in general.[49] The government did not meddle much with the economy, leaving commercial companies such as the VOC enough freedom to expand their business.

Another important factor for the success of book trade and the production of scientific books in the Netherlands, but also an important factor for the improvement of society in general, was the rise of literacy. Since primary education became more widespread throughout the country and among the different classes, the number of people who could read and write increased during the seventeenth century. Next to this, more people were able to send their children to secondary school and to newly founded academic institutions, such as Leiden University (1575), where students, both Dutch and foreign, could benefit from modern teaching programmes.[50]

Arguably the most important characteristics of the Netherlands during the seventeenth century, which would impact the success of the VOC and Dutch books in Japan, were tolerance and freedom of thought and religion. Not only in a political manner, as will be discussed in a later paragraph, the freedom the Dutch enjoyed thanks to the weak central government and the religious diversity of the Dutch people was also convenient for Dutch scholarship. During the seventeenth century, intellectual exchange was quite effective in the Netherlands and research was not only done by those active at the universities, but also by amateurs and private scholars.[51] Due to the rise of literacy and with that the rising demand for books, the seventeenth century was a busy period for

[47] Hoftijzer, "The Netherlands", p. 6.
[48] Ibid., p. 2.
[49] Ibid., p. 3.
[50] Ibid., p. 4.
[51] Ibid., p. 5.

authors, printers, and booksellers. On top of that, the political freedom provided by cities such as Amsterdam made sure the country became a very successful centre for the book trade in Europe. In the Netherlands many books were printed in bulk, especially Bibles in many different languages, to meet the almost insatiable demand throughout the whole of Europe.[52] As the Dutch were highly effective in producing large quantities of books at low costs, many printers became active in book piracy to compete with foreign original bestsellers. "Bibles, literary texts, scholarly books, and even musical compositions" were produced in high quality in their original language to be sold in their country of origin.[53] This successful bookmarket also provided the books that Japanese scholars would use for two hundred years, in an attempt to increase their scientific knowledge.

2.1.2 The Dutch East India Company in Japan

To further understand the exchange between the Dutch and Japanese, it is considered how the aforementioned characteristics influenced the relationship. The first time the Dutch entered Japan was in April 1600, when the Dutch vessel *De Liefde* was blown off its course onto the shore of Kyūshū, in southern Japan. After this news had reached the Netherlands in 1601, the Dutch immediately became interested in establishing a commercial relationship with the Japanese. The recently (1602) founded Dutch East India Company was in charge of acquiring commercial rights and establishing colonial territories east of Africa.[54] As a result, from around that time until the second half of the nineteenth century, the Dutch have a trading monopoly in Japan.

When the Dutch first arrived, the Portuguese and Spaniards had already established trade relations with Japan. These two countries tried to raise suspicion of the Dutch with the Tokugawa government. However, the Dutch representatives told the Japanese how the Netherlands had freed themselves from Catholic Spain and that these countries both had religious motives to be in Japan. The shogun then decided the Netherlands was not a religious country and slowly came to prefer their presence in Japan above that of the religious Spaniards and Portuguese. In the mean time, approximately two million Japanese had already been converted to catholicism and the shogun, whose control over the lords and domains was relatively new, feared the divide between religious beliefs would endanger his position.[55] The Dutch, who had no intention of doing missionary work and whose freedom of religion and thought had demonstrated to the shogun they were not (as)

[52] Ibid., p. 17.
[53] Ibid., p. 20.
[54] Goodman, *Japan and the Dutch 1600-1853,* pp. 9-10.
[55] Ibid., pp. 10-11.

religious as the Spaniards and Portuguese, gained the shogun's trust and eventually the monopoly on Japan's foreign trade. And so, a trading relationship that would last centuries was established.

Other characteristics positively impacted the exchange of knowledge. For example, the rules for mandatory travel to Edo of lords and their scholars which strengthened the shogun's control over the lords was extended to the Dutch VOC-personnel. This meant the Dutch had to travel to Edo to meet with the shogun every year, where they would answer questions and present gifts to express their gratitude for the privilege to trade with Japan.[56] These travels between Nagasaki and Edo created a network of knowledge throughout the land, which benefited both Dutch and Japanese scholars. The newly found wealth of the shogunate and the local lords created an opportunity to invest in scholarship and foreign books. The thriving Dutch book market produced many good and relatively cheap books, which the Dutch could bring to Japan. Since Amsterdam was the centre of the European book trade, the scientific books that would be brought into Japan were not only those of Dutch scholars, but also of English, French and German authors.

2.1.3 The Exchange of Knowledge

The social exchange relationship between the Netherlands and Japan was mostly focused on trade during the Tokugawa period. With regard to the presence or absence of trust in social networks, the trade relationship between the Netherlands and Japan is an interesting example of both. Although scholars agree trust is an important factor for successful social exchange between individuals, some social network scholars, such as Karen Cook, argue that social networks can be successful without mutual trust. Trust can be replaced by other factors, such as legal requirements or professional duty.[57] In the case of the Netherlands and Japan, trust was established during the initial contact, when the Dutch made clear not to have religious motives for being in Japan. In addition, trust was replaced by agreements on trade between the Dutch VOC and the Tokugawa government and by orders sent out by the shogun.[58] Next to these contracts, the Tokugawa government took further steps to avoid having to rely on trust. Dutch VOC-officials were obliged to regularly visit the shogun in Edo, similar to the obligation of the lords, during which visits new agreements were discussed and the Dutch entertained the shogun. This allowed the shogun to have a certain degree of control over the VOC, to the annoyance of some of its staff.[59]

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[56] Viallé, "Zingen voor de shogun", p. 35.
[57] Dillon, "Chapter 7: Exchange, Exchange Network, and Rational Choice Theories", p. 240.
[58] See, for example, Suzuki, *Japan-Netherlands Trade 1600-1800*, p. 11.
[59] Viallé, "Zingen voor de shogun", p. 37.

In contrast to trade, the knowledge exchange between the Netherlands and Japan during the Tokugawa period was very limited. There are several reasons for this, for example because the exchange between the Dutch and Japanese was focused on trade which limited the interest and ability to exchange knowledge. As trade between the Dutch VOC and the Tokugawa government thrived, Japanese officials from Nagasaki regularly visited the Dutch in their residence on the island of Deshima, in the bay of Nagasaki. These officials were mostly interpreters, sent by the government to learn Dutch and communicate with the VOC-officials. Since the officials' goal was to communicate (verbally) on trade and day-to-day business, their understanding of the Dutch language was often limited and conversations and written texts were focused on commerce.[60]

Next to this, most Dutch VOC-officials were not interested in any knowledge exchange that would not improve the trade between the Netherlands and Japan. According to Blau's theory of social exchange between individuals, this disinterest is a reason why the exchange was not successful. Blau states two conditions need to be met for social exchange to take place. First, the behaviour of the individuals must be oriented towards a goal which can only be achieved through interaction. Second, the individuals must adapt their means to further achieve these goals.[61] Since there was a mismatch in interests, the social exchange desired by the Japanese scholars was not established. The Dutch VOC-officials who were willing to share information with the Japanese on books and science often lacked the knowledge to do so. Thus, the Japanese scholars and officials who were trying to establish a social exchange network focused on knowledge, were often only in touch with Dutch seamen who simply did not know the answers to their questions on medicine and astronomy. This, of course, was a significant challenge for establishing a successful knowledge exchange network and one of the limits of *rangaku* and the knowledge exchange between the Netherlands and Japan during the Tokugawa period.

Of course, there were exceptions. Some key figures, such as Hendrik Doeff and Philipp Franz von Siebold, were very interested in Japan, its language, history, culture, flora and fauna. These VOC-officials had fruitful exchanges with the Japanese scholars, resulting in letters between the Dutch and Japanese, written accounts of travels and experiences in Japan, Dutch books gifted to Japanese officials, and sometimes lifelong friendships.[62]

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[60] Y. Frumer, "Before Words: Reading Western Astronomical Texts in Early Nineteenth-Century Japan." *Annals of Science* 73, no. 2 (2016), p. 173.
[61] Dillon, "Chapter 7: Exchange, Exchange Network, and Rational Choice Theories", p. 232.
[62] *Zashiki* were Japanese style salons where scholars and officials came together to discuss subjects such as poetry, art and science. See Jackson, *Network of Knowledge*, p. 45.

2.2 Rangaku: From conversation to translation

Within Japanese scholarship during the Tokugawa period, *rangaku* was an interesting activity. *Rangaku* (蘭学), which can be translated as 'Dutch Studies', was a movement of scholars and others interested in the study and translation of Dutch science and books. Eventually, as horizons broadened, the term can be translated as 'Western Studies', as *rangaku* began to encompass not only studies of all things Dutch, but all things western. The movement consisted of two main streams: the study of medicine and the study of astronomy. The exchange of medicinal knowledge is a very interesting part of *rangaku* and thus many scholars have covered the subject. The study of astronomy consisted of cartography, geography and studying the cosmos, but in Japan was heavily geared towards studying the calendar to improve the agricultural cycle.[63] Although astronomy is the topic of the primary materials of this research, the history of book exchange between the Japanese and Dutch is rich and encompasses not only books on astronomy, but on medicine and even subjects such as armory.

2.2.1 Rangaku and the Introduction of Western Books

During the seventeenth and eighteenth centuries, *rangaku* was based on conversations and lectures between scholars, officials, teachers and students. Until approximately 1774, *rangaku* scholars greatly depended on a social network. They would meet each other to share knowledge and discuss different topics. The *Oranda zashiki* ('Dutch salons') played an important part in the exchange of knowledge within *rangaku.* These salons were often organized by intellectuals who had some economic and cultural capital to show off. For example, head interpreter Yoshio Kōsaku (吉雄 幸作, 1724-1800), who was considered the most knowledgeable *rangaku* scholar in Japan of his time, ran a *Oranda zashiki.* The room was filled with western books and scientific objects to show to scholars who came to visit him there.[64] Study trips were one of the most important activities for *rangaku* scholars, as these allowed them to meet each other and exchange knowledge. Young students moved from the countryside to the cities to get a proper education at a *rangaku* academy and the aforementioned travels of the VOC-officials benefited those located in Edo.[65] *Rangaku* and its students thus depended on a network of knowledge exchange, based largely on the oral

[63] Goodman, *Japan and the Dutch 1600-1853,* p. 6.
[64] Jackson, *Network of Knowledge*, p. 45.
[65] Ibid., pp. 102-103.

transmission of information between teacher and student or scholars from different places.

During the period of oral transmission of *rangaku,* western books were already being imported in Japan in very small numbers. Before the VOC began actively importing books, western books were brought from China via Jesuit missionaries from Portugal. Originally, the Jesuits had brought western books to the Chinese emperor as a gift to gain favour. The books then found their way to Japan through Chinese "translations". These, however, were not actual translations, but treatises by the Chinese themselves based upon the western literature. With regard to astronomy this meant that the works of Copernicus, Galilei, Kepler and Newton, which were very important to the development of astronomy in Japan as we will see in chapter four, were never directly translated into Chinese but merely processed in their own works, often ending up with a simplified treatise. During the early seventeenth century, Japanese scholars did not have much choice when it came to scientific texts. They could either use traditional, neo-Confucian works on natural history or the handful of Chinese works described above.[66]

The selection of scientific works from overseas in Japan remained limited due to the ban on foreign books of 1630. In this year, shogun Tokugawa Iemitsu (徳川家光, 1604-1651) issued the Edict of Kannei, which forbade the import of western religious books, including those written in or translated into Chinese. Whenever the Japanese believed the books were aimed at the propagation of Christianity, they would not allow them to enter the country through official channels.[67] Books that came into Japan as regular cargo had to be inspected by government officials. [68] However, other books were imported as side cargo and privately sold by VOC-officials. In order to legally acquire a book, Japanese scholars and collectors had to request them in an *eis* (demand). *Eisen* were a list of objects requested by various Japanese people, such as the interpreters assembled in a college in Nagasaki, the *bakufu* itself, and lords with enough social and economic capital.[69] Some relied on their personal relations with the Dutch to acquire books, but these transactions are hardly documented. The most frequent books that were acquired by the Japanese until the second half of the eighteenth century were Rembertus Dodoens' *Cruydt-boeck* (Herb book, first published in 1554), Lorenz Heister's *Heelkundige onderwyzingen* (Instructions in surgery, translated to Dutch by Hendrik Ulhoorn, published in Amsterdam in 1718), Johann Hübner's *Kort Begrip der Oude en Nieuwe Geographie* (Brief concepts of old and new geography, published in Amsterdam in

[66] Montgomery, *Science in Translation*, pp. 206-208.
[67] Goodman, *Japan and the Dutch 1600-1853,* pp. 34-35.
[68] Montgomery, *Science in Translation*, p. 202.
[69] Jackson, *Network of Knowledge*, p. 119.

1675), and Johannes Jonstonus's *Naeukeurige Beschryving van de Natuur der Viervoetige Dieren* (Accurate description of the nature of the four-legged animals, 1660).[70]

A shift occurred within *rangaku* after the publication of *Kaitai shinsho* (A new treatise on anatomy) in 1774. *Kaitai shinsho* was a translation project of Sugita Genpaku (杉田玄白, 1733-1817), Maeno Ryotaku (前野良沢, 1723-1803) and some of their friends which lasted three years, aimed at translating Dutch editions of anatomical texts, such as Johann Adam Kulmus's *Ontleedkundige tafelen* (Anatomical tables, published in Amsterdam in 1734).[71] The publication of *Kaitai shinsho* was seen as groundbreaking and increased the enthusiasm for Dutch Studies among Japanese scholars, and especially among physicians. After 1774, *rangaku* became increasingly dependent on texts, most importantly Dutch books, either original works or translations. Especially in the field of medicine, physicians and scholars moved on from oral transmission and hands-on-training to reliance on Dutch medical books. By the end of the eighteenth century, the use of western books became an accepted feature and the import of books became normalized to the point that scholars desired the latest editions from the Netherlands. In the first half of the nineteenth century, the importance of contemporary Dutch books was such an integrated part of *rangaku* that editions from before 1800 were regarded as outdated. However, the acquisition of the desired new editions was not an easy thing, which again illustrates the vital importance of a social network for exchanging books and translations.[72]

2.2.2 The Introduction of Astronomy in Japan

The shift from oral transmission to a dependency on texts within *rangaku*, which was discussed above, was part of a greater turning point in Japanese science: a shift towards modern science, including western astronomy. The introduction of western astronomy, such as the Copernican system, in Japan was late. According to Nakayama, there are three factors that can explain why the introduction of the heliocentric theory was so slow. However, these factors are not only relevant for the introduction of Copernicus's theory, but for astronomy and western science as a whole. First, as described before, political action limited free international communication.[73] Second, those who tried to translate western books struggled with the language barrier and as a result many scholars were held back from learning more about western science. Third, ideological and technical

[70] Ibid., p. 199 and pp. 170-171.
[71] Ibid., p. 26.
[72] Ibid., p. 117.
[73] Nakayama, "On the Introduction of the Heliocentric System into Japan", p. 4.

difficulties limited the comprehension of theories such as the heliocentric system as well. Those who did not struggle as much with the language often lacked the specific knowledge to fully grasp the concepts presented by western scholars or were held back in accepting and understanding the concepts due to ideological conflicts.

Towards modern science

Japan's shift towards what we now consider their modern science, occurred not before the eighteenth century due to the first factor listed above: political actions which prohibited communication with the rest of the world. Even the communication that was not forbidden was still heavily regulated by the government. Exchange of knowledge through books was in fact easier to regulate than speech or letter writing for the shogun. In his book *Science in Translation* (2000), Montgomery argues that modern science in Japan was established almost entirely in the late eighteenth century. He immediately follows this claim with the explanation that the late eighteenth century saw the lifting of the strict ban on western books.[74] So, what happened during that time? In 1716 Tokugawa Yoshimune (徳川吉宗, 1684-1751) became shogun. Yoshimune was a man with an inquisitive nature and an interest in science and scholarly pursuits. He acknowledged that western science could be beneficial for the Tokugawa government and therefore lifted the existing ban on the import of books. This decision is not considered to have had a large impact on *rangaku* at first. The books which were now permitted were not circulating across the land and only a small group close to the shogun were familiar with the lifting of the ban.[75]

Yoshimune's influence on scholarship and *rangaku* in Tokugawa Japan was great, mostly because of his so-called Kyoho reform. Among others, this reform introduced a policy which was the first official attempt of the *bakufu* to study *rangaku* and adopt western science to benefit the government.[76] He is also known for boosting scholarly pursuits in the field of astronomy, because of his interest in calendrical studies. The shogun wanted to increase agricultural production and encouraged scholars to study the western calendar, climate and astronomy to improve their own calendar and agricultural methods.[77] This meant the study of astronomy by *rangaku* scholars was not only allowed, but actually supported by the government for the first time.

[74] Montgomery, *Science in Translation*, p. 202.
[75] Goodman, *Japan and the Dutch 1600-1853,* p. 52.
[76] Ibid., p. 49.
[77] Ibid., p. 50.

Difficulties with translation and a lack of domain knowledge

The *rangaku* scholars who worked on the study of the calendar can be divided in different groups. For example, some studied the subject on their own out of a private interest, others were assigned by the shogun, and then there were scholars who were a mixture of the two. In general, however, there were two types of scholars who worked on astronomy. The first type consisted of interpreters who could read western books, but had little knowledge of mathematics and astronomy. The second type were mathematicians and other intellectuals who knew little of the Dutch language. The interpreters in Nagasaki were the ones who came into contact with the Dutch VOC-personnel, who ordered books from them through the *eisen* and who wrote some of the most influential *rangaku* books of their time. Nagasaki interpreters were the only scholars who could directly buy books from VOC-officials. The only customer mentioned by name in the *eisen,* who was not a high-ranking official or a lord, was head interpreter Yoshio Kōsaku (吉雄幸作, 1724-1800). Yoshio was one of the few scholars who was able to compile a library of Dutch books thanks to his position as a Nagasaki interpreter.[78] Those who could translate Dutch thus had a great advantage over other scholars when it came to acquiring books. However, they did not necessarily have an advantage in understanding the material, due to their lack of knowledge on the subjects. As Frumer points out, the process of translating a Dutch scientific work was very difficult, as it meant the translator had to study not only the scientific material, but also the European terms and practices. Thus, a translator had to become familiar with the European language, culture and, in the case of scientific literature, mathematical symbols, the meanings of greek letters, algorithms, and graphs. Lastly, a good translator is required to have an existing body of knowledge on the subject to which they could connect the foreign knowledge, something most Japanese translators lacked.[79]

For mathematicians and astronomers the situation was the other way around. They had the domain knowledge and were more likely to comprehend the theories and understand the mechanics behind them, and thus would make better authors of Japanese astronomical works. However, their lack of understanding the Dutch or other European languages made it impossible for them to fully comprehend the theories in the imported books.[80] Even if the Japanese mathematicians understood enough of the Dutch language, the Japanese way of thinking about

[78] Jackson, *Network of Knowledge*, p. 121.
[79] Frumer, "Before Words" , p. 172.
[80] Ibid., p. 176.

astronomy and mathematics, which was firmly rooted in Chinese concepts, was a serious obstacle. For example, Japanese astronomers were often focused on arithmetic methods, while western astronomy worked with trigonometrical diagrams to make abstract representations of the cosmos. However, gradually Japanese astronomers adopted the "European mathematical way of thinking" so critical for the development of modern Japanese science.[81]

Ideological conflicts

Nakayama states as a third factor that there were ideological difficulties in understanding the heliocentric system as suggested by western astronomers. The scholars who studied the heliocentric system were often *rangaku* scholars who acknowledged the usability of western science. During the late eighteenth century a new type of *rangaku* scholar, especially among those interested in astronomy, emerged. These scholars were educated in the Chinese classics and often were followers of Confucius. Yet they believed European books could be useful tools for the study of nature.[82] In contrast to Buddhism, Confucian ideas could be combined with western science quite smoothly, especially in the case of astronomy and the introduction of the Copernican system. There was opposition as some Confucianist scholars were fiercely against everything western, but in general, according to Nakayama, "there was no clear point of conflict with Western cosmology."[83]

The shift towards using western books was no smooth transition, nor a fast one. When it came to the study of astronomy, *rangaku* scholars had to advocate the use western sources for decades. During the eighteenth century these scholars worked on revising the calendar, after shogun Yoshimune had first given the order to do so in 1720. Those who wanted to use western science in calendrical studies advocated changes such as using the 360 degrees for coordinates instead of the Chinese 365,25. However, these scholars were held back by the *bakufu* after the death of Yoshimune and the *bakufu* gave the scholars a lot of backlash. It took 78 years since Yoshimune had first ordered Japanese scholars to study the calendar with the use of western sources for them to finally be able to use the 360 degrees in astronomy. In this case, it was the government that struggled with the ideological conflict. However, as will become clear in the next chapter, some scholars indeed had trouble comprehending western science due to their neo-Confucian background.

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[81] Ibid., pp. 174-175.
[82] Montgomery, *Science in Translation*, p. 208.
[83] Nakayama, "On the Introduction of the Heliocentric System into Japan", p. 14.

Chapter 3

The Dawn of Astronomy in Japan

To further illustrate how the Dutch did and did not influence Japanese science during the Tokugawa period, this chapter will discuss a few key Japanese figures in order to demonstrate what role they played during the dawn of astronomy in Japan and how the Dutch and Dutch books influenced their work.

3.1 Motoki Ryōei (1735-1794)

One of the early Japanese scholars who contributed to the rise of astronomy in *rangaku* was Motoki Ryōei, also known as Yoshinaga, Nidaiyu, Einoshin and Rankō. He was born in 1735 in Nagasaki as the son of a physician and was later adopted by an interpreter and translator of Dutch who gave him lessons in the Dutch language.[84] In 1748, Motoki became an apprentice interpreter in Nagasaki, the third-generation of his family to do so. Around 1788, Motoki reached the rank of senior interpreter (*otsuji*) which meant that he was given special duties.[85] Depending on the year, Motoki had to take care of all comings and goings of high officials and accompany the Dutch on their *hofreis*. Motoki accompanied the Dutch on three occasions, in 1785, 1788, and 1790.[86]

Being an official interpreter, especially in the position of *otsuji*, meant to have contact with the Dutch, both on official duty and in personal relationships.[87] As an official interpreter stationed in Nagasaki, Motoki consequently had more opportunities within *rangaku* than other scholars. As was made clear in the last chapter, scholars could not easily access Deshima to connect with the Dutch, unless one had special permission, as was the case for the interpreters. Like other interpreters, Motoki had established personal relations with VOC-officials, among whom Isaac Titsingh (1745-1812). Titsingh was born in Amsterdam and made quite a career within the VOC.

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[84] JapanKnowledge, "本木良永" <https://japanknowledge-com.ezproxy.leidenuniv.nl:2443/lib/display/?lid=1001000225228> (15 September 2020).
[85] Goodman, *Japan and the Dutch 1600-1853*, p. 98.
[86] H.W.K. de Groot, *The Study of the Dutch Language in Japan during Its Period of National Isolation (ca. 1641-1868)* (Christchurch: University of Canterbury, 2005), p. 37 note 50.
[87] Goodman, *Japan and the Dutch 1600-1853*, pp. 32-33.

When he was stationed in Japan as *opperhoofd* his personal goal was to collect everything he could find on the shogun and Japan.[88] In order to do so, Titsingh connected with Japanese translators and scholars to keep a well of information at hand. During his third incumbency, from August 1784 to November 1784, Motoki Ryōei was a junior interpreter.[89] Titsingh and Motoki had, in all likelihood, regular contact with each other during Titsingh's stay in Japan. This is apparent from the documents Titsingh and Motoki worked on when describing and depicting an ancient Dutch anchor. Titsingh confirmed the anchor was Dutch, as Motoki drew the anchor and translated Titsingh's text for the lord of Hirado.[90] After leaving Japan, Titsingh stayed in contact with Motoki for another decade by writing letters and exchanging presents.[91]

It is also possible Motoki had relations with *daimyo,* such as the lord of Satsuma, in all likelihood Shimazu Shigehide (島津重豪, 1745-1833) between 1755 and 1787. There were several *daimyo,* among them Shigehide, who were interested in Dutch studies and hired interpreters to help them translate Dutch books. Since Motoki Ryōei was described as a man who was fully devoted to learning and translating books in the Dutch language, it would be quite possible for him to have worked for these lords.[92]

Through relations such as these, Motoki had access to new knowledge and, most importantly for his career as a translator and scholar, European books. But there were other, more important and powerful, Japanese officials with connections to the Dutch such as head interpreter Yoshio Kōsaku (吉雄 幸作, 1724-1800, also known as Yoshio Kozaemon or Yoshio Kōgyū) and Hiraga Gennai (平賀 源内, 1728-1780).[93] Motoki Ryōei used his connections with his colleagues to gain more access to books. It is known that Motoki loaned books from Hiraga Gennai and was invited to his private library. Motoki regularly consulted Gennai's collection of foreign books,

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[88] I. Titsingh and T. Screech, *Secret Memoirs of the Shoguns: Isaac Titsingh and Japan, 1779-1822* (London: Routledge, 2006), p. 2.
[89] Ibid., p. 21.
[90] LULDC, East Asia Vision, 22472, "An official statement addressed to Matsuura Seizan, Lord of Hirado, by Isaac Titsingh, dated December 1782. It confirms that an ancient anchor (painted on the document by the translator Motoki Ryôei) found in the Bay of Hirado, is indeed of Dutch origin, and must date from the time when the Dutch had their factory there, 'some 160 years ago'. The anchor had been found in March 1782, after which the Lord of Hirado, an avid collector of western curiosa, had inquiries made at Deshima". Scanned from 日蘭交流のかけ橋: *Exhibition 'Bridge between Japan and the Netherlands: Through the Eyes of the "Oranda-Tsūji" or the Japanese Interpreters of Dutch'* (Kobe: Kobe City Museum, 1998), p. 42, pl. 45, <http://hdl.handle.net/1887.1/item:1580848> (28 September 2020).
[91] Titsing and Screech, *Secret Memoirs of the Shoguns*, p. 23.
[92] A. Horiuchi, "When Science Develops outside State Patronage: Dutch Studies in Japan at the Turn of the Nineteenth Century", *Early Science and Medicine*, 8, no. 2 (2003), p. 163.
[93] Jackson, *Network of Knowledge*, p. 121.

which contained a variety of books by Dutch authors.[94] Through this small network of Dutch VOC-personnel and other Japanese officials, either those with more wealth or authority, Motoki was able to acquire the necessary titles for his translations, among which some of the most important works in the history of Japanese astronomy.

3.1.1 Introduction of Copernicus

Although scholars are still debating which text introduced the heliocentric theory of Copernicus in Japan, they seem to agree Motoki Ryōei was the first interpreter who translated a portion of Copernicus' ideas into Japanese. Therefore, Motoki is often credited for introducing Copernicanism in Japan. One of the works of Motoki is *Taiyōkyori-rekikai* (Explanation of the solar distance calendar, 1774). This is a text on the solar system, which was edited by Matsumura Genkō (松村元綱).[95] Motoki created this manuscript because he thought it was necessary to introduce a Japanese-Dutch calendar as the new imperial calendar. The original on which Motoki based his work is unknown. The only book mentioned as a reference was called "*Graadboeck",* a book used to navigate the sea.[96] However, it is unclear which exact title is referred to.[97] According to the website of the Digital Collections of Leiden University, this manuscript is the earliest Japanese texts which contains information on the solar calendar.[98]

Another one of Motoki's works which features Copernican ideas is *Oranda chikyu zusetsu* (Dutch illustrated treatise on the earth), written in 1773. it is based on the *Atlas de la navigation et du commerce* by Louis Renard, which was originally published in Amsterdam in 1715. However, Motoki used the Dutch translation *Atlas van zeevaert en koophandel door de geheele weereldt* (Atlas of maritime and commerce throughout the world) published in Amsterdam in 1745, which contained updated knowledge on maps and astronomy.[99] These updates also contained references

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[94] Ibid., p. 127.
[95] Years of birth and death unknown.
[96] 日蘭交流のかけ橋: *Exhibition 'Bridge between Japan and the Netherlands: Through the Eyes of the "Oranda-Tsūji" or the Japanese Interpreters of Dutch'* (Kobe: Kobe City Museum, 1998), p. 208.
[97] *Graadboeck* might refer to Claes Jansz Vooght's *Nieuw Amsterdammer Graad-boek* (Amsterdam, 1679) or perhaps Willem Jansz Blaeu's *Nieuw Graetboeck* (Amsterdam, 1605). However, there are other navigation books like these and except for the title *Graadboeck*, no further information is known.
[98] Leiden University Libraries Digital Collections, East Asia Vision, 22533, "Manuscript: 'Taiyô kyûri ryôkaisetsu wage sôkô', 'A Draft Explanation in Japanese of the Scientific Theories concerning the Solar System', The earliest text about the solar calendar in Japanese, based on a Dutch text called 'arâdobuki', 'graad-boek', in the introduction. Written by Motoki Ryôei and edited by Matsumura Genkô, dated 1774", scanned from 日蘭交流のかけ橋: *Exhibition 'Bridge between Japan and the Netherlands: Through the Eyes of the "Oranda-Tsūji" or the Japanese Interpreters of Dutch'* (Kobe: Kobe City Museum, 1998), p. 112, pl. 179, <http://hdl.handle.net/1887.1/item:1579691> (28 September 2020).
[99]Goodman, *Japan and the Dutch 1600-1853,* p. 98.

to Copernicus's theory on heliocentrism and by translating it Motoki Ryōei became, according to Goodman, another contestor for producing the first Japanese text on Copernican theory.[100] The *Atlas van zeevaert* was published by mapmakers Reinier and Iosua Ottens, who added new and improved maps and drawings. Jan van den Bosch Melchiorsz added descriptions to these maps as well as remarks on physics, astronomy, geography and meteorology.[101]

Motoki did another interesting translation of a well known Dutch work by Willem Janszoon Blaeu (1571-1638). Blaeu is one of the most interesting figures in Dutch book history. He began his career as a student of the famous Danish astronomer Tycho Brahe and went on to become a well known astronomer, instrument maker and printer and bookseller. The last were his most important occupations, as he and his sons were the printers of maps and atlases of the highest quality in Europe during the seventeenth century. Blaeu's printing office in Amsterdam produced a large variety of printed works, but his most famous publications are the books containing maps: atlases and books on navigation.[102] It is one of these books that fell into the hands of Motoki Ryōei.

Tenchi nikyū yōhō (Twofold education on the universe, 1774) is a translation of Blaeu's *Tweevoudigh Onderwijs van de Hemelsche en Aerdsche Globen: Het een na de Meyning van Ptolemeus met een Vasten Aerdkloot, het Ander na de Natuerlijcke Stelling van N. Copernicus met een Loopenden Aerdkloot*, first published in 1634 in Amsterdam.[103] Motoki's manuscript probably formed the basis of what would later become his most important work, *Seijutsu hongen taiyō kyūri ryōkai shinsei tenchi nikyū yōhōki* (The foundation of astronomy, newly edited and illustrated; on the use of celestial and terrestrial globes according to the heliocentric system, 1793), which was a translation of *Gronden der Starrenkunde, gelegd in het Zonnestelzel bevatlijk gemaakt; in eene Beschrijving van 't Maaksel en Gebruik der Nieuwe Hemel- en Aard-Globen,* originally titled *Describing and explaining the construction and use of new celestial and terrestrial globes* by the English astronomer George Adams, published by Kornelis van Tongerlo in Amsterdam in 1770 with notes from Jacob Ploos van Amstel.[104]

The translation of Blaeu's book by Motoki Ryōei cannot be considered a complete

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[100] Goodman, *Japan and the Dutch 1600-1853,* p. 98.
[101] See "Natuurkundige Aenmerkingen over de Sterre-en Aerdtryskunde, Zeën en Winden" on the title page of L. Renard and J. van den Bosch, *Atlas van Zeevaert* (Amsterdam: Reinier and Iosua Ottens, 1745), seq. 7 via <https://iiif.lib.harvard.edu/manifests/view/drs:43374219$7i> (2 October 2020).
[102] Hoftijzer, "The Netherlands".
[103] The title of Blaeu's book roughly translates to Twofold Teaching of the Celestial and Terrestrial Globes: One after Ptolemy's View with a Fast Earth Globe, the Other after N. Copernicus's Natural Theorem with a Moving Earth Globe.
[104] Goodman, *Japan and the Dutch 1600-1853,* pp. 98-99.

introduction and explanation of Copernican theory and modern western astronomy, as it only briefly mentions Copernicus.[105] There some possible explanations for the lack of Copernican theory in *Tenchi nikyū yōhō*. An explanation would be that Motoki simply did not have access to enough in-dept sources on Copernican theory, as Blaeu's book might have been the only one available to him during the writing of *Tenchi nikyū yōhō. Tweevoudigh Onderwijs* was a fine introduction to globes, the position of the earth and its movement and other astronomical subjects where Blaeu made use of the theories of the Ancient Greek scholar Ptolemy and Copernicus. However, their original theories would not have been available for Motoki as they were written in languages he did not master.

It is also possible Motoki's understanding of the theory and the Dutch language were limited which meant he could not convey the theory in his manuscript well enough. Lastly, due to his official business as an interpreter, it may have been that Motoki did not want to take his chances with the strict rules of the government, who supported Neo-Confucian cosmology and rejected Copernicus' heliocentrism.[106] For whatever reason, *Tenchi nikyū yōhō* only briefly mentions Copernicus, but its successor *Seijutsu hongen taiyō kyūri ryōkai shinsei tenchi nikyū yōhōki* would finally give the Japanese a more elaborate introduction to heliocentrism.

3.1.2 Seijutsu hongen taiyō kyūri ryōkai shinsei tenchi nikyū yōhōki

The manuscript *Seijutsu hongen taiyō kyūri ryōkai shinsei tenchi nikyū yōhōki* (The basis of astronomy, newly edited and illustrated; on the use of celestial and terrestrial globes according to the heliocentric system, 1792-93) was a translation of the Dutch edition of *A Treatise Describing and Explaining the Construction and Use of New Celestial and Terrestrial Globes* (1746) by the English astronomer George Adams.[107] The Dutch translation, *Gronden der Starrenkunde, gelegd in het Zonnestelsel* (1771), was made by Jacob Ploos van Amstel in Amsterdam. According to Annick Horiuchi, this manuscript is responsible for the introduction of the Copernican system in Japan.[108] The manuscript addresses the solar system, the earth as a part of this system, and the planets and their courses.

The books Motoki Ryōei used for his translations were most likely borrowed and there are

[105] Ibid., p. 99.
[106] Ibid.
[107] Horiuchi, "When Science Develops outside State Patronage", p. 163; S. Nakayama, "Diffusion of Copernicanism in Japan", p. 73.
[108] Ibid.

no records of the interpreter in the *daghregisters*. It is known, however, that at least one version of Adams's work was in Japan, in the possession of the *Bansho Shirabesho*, or the Institute for the Study of Barbarian Books.[109] Since Motoki relied on his connections and privileges as an interpreter instead of personal wealth and collections, it could be that he used the edition of the *Bansho Shirabesho.*

Next to George Adams's work, Motoki made use of the Dutch edition of Benjamin Martin's (1704-1782) *The Philosophical Grammar* (London, 1735) which was published as a second edition in Amsterdam in 1744. It was called *Filozoofische Onderwyzer,* (a translation of philosophical grammar), but it's entire title also included *of Algemeene Schets der Hedendaagsche Ondervindelyke Natuurkunde* (or General outline of contemporary experiential physics). The book included chapters on the globe, materials such as metals, seas and rivers, plants and the bodies of animals and humans.[110] It was often requested by the Japanese from the VOC. For example, in the "Eis van de stadsburgermeester en het college" (Demand of the mayor and the college) from 1765, page 2 lists "Filozoophise onderweijser" (Philosophical Grammar) next to "Kort begrijp der oude en nieuwe Geographie" (Brief understanding of old and new geography) and "Schets der Hollandsche Natuurkunde" (Sketch of Dutch physics).[111] The request for these books appear under the subtitle "Voor Collegie", meaning the interpreters of Nagasaki.[112] Thus, there is a possibility this request for *The Philosophical Grammar* was fulfilled and Motoki had access to the book through the "College" as an interpreter. Another book used by Motoki for this treatise was *Anfangsgründe der Physik* (Leipzig, 1753) by Johann Heinrich Winkler, published in Dutch as *Beginselen der natuurkunde* (Principles of Physics, Amsterdam, 1768).[113] Who was in the

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[109] LULDC, East Asia Vision, 22534, "Title page: 'Gronden der Starrenkunde, gelegd in het Zonnestelsel' (Amsterdam, 1771), the Dutch version of George Adams' treatise about the solar system, trsl. by Jacob Ploos van Amstel. Original title reads 'Treatise Describing and Explaining the Construction and Use of the New Celestial and Terrestrial Globe', (London, 1766). On the opposite page a paper slip with the translated title and library classification; once owned by the 'Bansho shirabe-dokoro'." Scanned from 日蘭交流のかけ橋: *Exhibition 'Bridge between Japan and the Netherlands: Through the Eyes of the "Oranda-Tsūji" or the Japanese Interpreters of Dutch'* (Kobe: Kobe City Museum, 1998), p. 113, pl. 180, <http://hdl.handle.net/1887.1/item:1581563> (3 October 2020).

[110] B. Martin, *Filozoofische Onderwyzer, of Algemeene Schets der Hedendaagfche Ondervindelyke Natuurkunde* (Amsterdam: Isaak Tirion, 1744), via Google Books, <https://books.google.nl/books?id=SS9nAAAAcAAJ&pg=PA5&dq=Filozoofische+onderwyzer+of+algemeene+schets&hl=nl&sa=X&ved=0ahUKEwjj0rCahujlAhUKJVAKHcWqACoQ6AEIKzAA#v=onepage&q=Filozoofische%20onderwyzer%20of%20algemeene%20schets&f=false> (3 October 2020).

[111] Het Geheugen/Het Nationaal Archief, Japanse eisen, 1370, Eisen van de stadsburgermeester en het college, p. 2, via <https://geheugen.delpher.nl/nl/geheugen/view/eis-stadsburgermeester-college?query=&facets%5BcollectionStringNL%5D%5B%5D=Japanse+eisen&page=1&maxperpage=36&period=1700%2C1817&coll=ngvn&sortfield=date&identifier=NA01%3A00006001819> (3 October 2020).

[112] Ibid.

[113] Goodman, *Japan and the Dutch 1600-1853,* p. 99.

possession of this book and how Motoki gained access to it is unclear.

3.1.3 Limitations of Motoki Ryōei's Work

As an introduction to Copernican theory, one could argue *Seijutsu hongen taiyo* still falls short. Adams's work was a text for navigation and not an astronomical work, which meant Motoki's translation introduced many concepts of Copernican ideas but missed the scientific explanations for them.[114] As an interpreter he lacked knowledge on mathematics, astronomy and natural history in order to translate these scholarly works effectively. This is considered one of his limitations as a translator and of his influence on *rangaku*.[115]

Even though Motoki Ryōei is seen as the one who introduced a very important western scientific theory in Japan, his influence on scholarship and *rangaku* was limited. Compared to scholars, interpreters had a very different social status, and therefore education and occupation. Although interpreters were allowed to wear swords due to their official government positions, they were still part of the lower class of commoners. This means they did not receive such a broad education as the boys from the *samurai* class had, who would later grow up to be the lords the interpreters worked for.[116] Interpreters were also limited in their travels. They often stayed in Nagasaki, unless they had to accompany the Dutch embassy to Edo.[117] Since interpreters were mainly trained to communicate with VOC-officials, their translations were often focused on the linguistic quality. Due to their lack of scholarly education, their work was not necessarily focused on accurately representing scientific knowledge and western thought. In some cases, elements of western thought were even omitted from the translation, as was in the case of Motoki's *Oranda chikyu zusetsu*. The Dutch edition contained biblical and theological references, but as Nakayama has explained, Motoki omitted these references in his translation.[118]

Thus, next to lacking the proper knowledge on astronomy and other natural sciences, Motoki Ryōei was also limited in which translations he could do, what messages he could convey with his manuscripts and what books he could use as source material. Being an interpreter both had a negative and positive effect on Motoki's accomplishments. On the one hand, he lacked the

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[114] Ibid., p. 99.
[115] Horiuchi, "When Science Develops outside State Patronage", p. 163 ; Goodman, *Japan and the Dutch 1600-1853,* pp. 99-100.
[116] Horiuchi, "When Science Develops outside State Patronage", p. 149.
[117] Ibid.
[118] Goodman, *Japan and the Dutch 1600-1853,* pp. 92 and 253, note 38; S. Nakayama, "Abhorrence of 'God' in the Introduction of Copernicanism into Japan," in **... eds.** *The Orientation of Science and Technology: A Japanese View* (Folkestone: Global Oriental, 2009), p. 31.

status, education and economic wealth to gain access to western books, but his status as interpreter removed these barriers. On the other hand, his official position within the government meant he had little freedom in his travels, contacts, and even writing.

3.2 Shimazu Shigehide (1745-1833)

Next to interpreters, some *daimyo* were *rangaku* scholars who played an important role in the development and distribution of *rangaku* in Tokugawa Japan. As discussed above, *daimyo* and merchants had the means to buy western scientific objects, such as globes, clocks, sextants, and books. An interesting example of a lord with plenty of resources and an interest in *rangaku* is Shimazu Shigehide. In 1755, at the age of only ten he became lord of Satsuma, one of the most powerful domains of the Tokugawa period, which he ruled until 1787. After his official retirement, Shimazu Shigehide continued to have an impact on the politics of Satsuma and Japanese scholarship until his death in 1833. He was fluent in Chinese, the language of scholarship and government during the Tokugawa period, and was very much interested in *rangaku,* especially the study of plants for medicinal use, but he was also very active in other fields of scholarship in Japan, both as a scholar himself and as a sponsor for others. Throughout his lifetime, Shigehide sponsored publications on medicine and other subjects, sustained an active institute of medicine, created a medicinal garden and an astronomical observatory, hired scholars for experiments and wrote books such as encyclopedias himself.[119]

3.2.1 The "Prince of Satsuma" in Edo

Shimazu Shigehide spent most of his time after his retirement in his salon in Edo, where he met with scholars, naturalists and artists.[120] These salons, both the physical place and the gathering itself, are called *zashiki* and were often used by those interested in *rangaku* to meet and discuss. During these informal gatherings participants used to talk about poetry, religion, ethics, science, and other topics of interest. During the eighteenth century, two main developments created a fertile environment for these *zashiki.* First, the expanding population and the new type of townspeople in Edo, who did not care much about social status, contributed to an environment where citizens from all layers of society could connect and discuss. Second, the rise of *rangaku* in

[119] F. Marcon, *The Knowledge of Nature and the Nature of Knowledge in Early Modern Japan* (Chicago: University of Chicago Press, 2015), p. 286.
[120] Ibid., p. 286.

the latter half of the eighteenth century contributed to the establishment of a social network throughout Japan of scholars who exchanged ideas and knowledge.[121] The *zashiki* was the location where scholars developed, maintained and expanded their social connections and *rangaku* knowledge. Shimazu Shigehide ordered a mansion built for him, which looked like a Dutch house. It was located in Edo and Shigehide used the place as a *zashiki,* which was open for *rangaku* scholars. Shigehide also made use of the generosity of others, for example when he stayed with interpreter Imamura Genuemon (今村 源右衛門, 1720-1773), in Nagasaki whenever he visited the Dutch. Furthermore, Shigehide was a patron for the scholars Narabayashi Jūbei (1687-1756)[122], Isonaga Sukei, and Ishizuka Saiko.[123] Moreover, he hired the interpreter Monjūrō as his "Dutch advisor"[124], the interpreter Matsumura Genkō to study astronomy and the calendar, and the botanists So Senshun (曽 占春, 1758–1834) and Shirao Kokkei (白尾 国柱, 1762-1821) to compile a volume on useful agricultural plants.[125]

Next to Japanese scholars, artists and officials, Shigehide also communicated frequently with Dutchmen in Edo. Among them were Hendrik Doeff (1777-1835), Isaac Titsingh, and Philipp Franz von Siebold (1796-1866).[126] Shimazu Shigehide and other lords used their relationships with these VOC-officials to acquire knowledge and gain access to European books. For example, Shigehide obtained books on botany, zoology, and calendrical studies through Titsingh and von Siebold.[127] As to his correspondence with Hendrik Doeff, little is known. However, the relationships with Isaac Titsingh and Philipp Franz von Siebold are better documented.

Isaac Titsingh travelled to Edo in 1780, where he met several important people, among them Shimazu Shigehide.[128] They had a mutual friend named Kutsuki Masatsuna (1750-1802), the daimyo of Fukuchiyama. The relationship between Kutsuki and Titsingh has been documented in *The Private Correspondence of Kutsuki Masatsuna and Isaac Titsingh 1785-1807* (1992), edited by Frank Lequin. This collection of personal letters shows the nature of the intimate friendship between this Dutch and Japanese scholar, which led to an elaborate exchange of scientific and

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[121] Jackson, *Network of Knowledge,* pp. 60-61.
[122] Ibid., pp. 46-47.
[123] Goodman, *Japan and the Dutch 1600-1853,* p. 158. Some dates and spellings unknown.
[124] Titsing and Screech, *Secret Memoirs of the Shoguns*, pp. 22-23.
[125] Goodman, *Japan and the Dutch 1600-1853,* p. 157. See the encyclopedia at <https://digitalcollections.universiteitleiden.nl/Japanese_agriculture_19th_century> (27 April 2021).
[126] Goodman, *Japan and the Dutch 1600-1853,* p. 158.
[127] Jackson, *Network of Knowledge,* p. 129.
[128] C.R. Boxer, *Jan Compagnie in Japan, 1600-1850: An Essay on the Cultural, Artistic and Scientific Influence Exercised by the Hollanders in Japan from the Seventeenth to the Nineteenth Centuries* (The Hague: Nijhoff, 1950), p. 142.

cultural knowledge. In their letters, both Kutsuki and Titsingh mention their mutual friend Shigehide and often speak about the books they exchanged with one other. Titsingh regularly sent books to Kutsuki and perhaps to Shigehide as well, as the letters show Titsingh received gifts from the lord of Satsuma.[129]

In a letter from Titsingh to Kutsuki of 28th of March, 1788 Isaac Titsingh describes his wish to visit Japanese places freely and undisturbed through the wealth of the lord of Satsuma, meaning Shigehide, since his son-in-law was now on the throne.[130] He also asks Kutsuki to give his thanks to Shigehide for the "vyf stukken zyde stof" (five pieces silk fabric) sent to him in 1786 by the lord.[131] Titsingh closes the letter with a list of questions on Japan and the Japanese people, perhaps hoping Kutsuki could give him the answers to eventually finish his book on Japan. The work, entitled *Cérémonies usitées au Japon, pour les mariages et les funérailles: suivies de détails sur la poudre Dosia, de la préface d'un livre de Confoutzée sur la piété filiale* would by the way not be published until 1819, translations into English and Dutch appearing in 1822 and in 1824 respectively.[132] As apparent from the title, Titisngh was interested in the marriage rituals of the Japanese and had a particular interest in the marriage between the current shogun and Shigehide's daughter.[133] The letters, thus, mention Titsingh's wish that Shigehide would sponsor his journey back to Japan and the lord's relations with the shogun. In one of his final letters to Kutsuki Masatsuna from 1801, Titsingh declares he would publish his account on Japan as soon as he would return to the Netherlands (he was in London at the time) and he would dedicate this work to both Shimazu Shigehide and Kutsuki Masatsuna in honour of their ongoing friendship.[134]

Philipp Franz von Siebold (1796-1866) was a military surgeon in the service of the Dutch East India army who in 1817 he was sent to Japan to conduct scientific research and supervise the health of the Dutch VOC-personnel and ships crews in Nagasaki.[135] In 1826, Siebold went with the Dutch mission to Edo on the annual *hofreis*, where he eventually met Shimazu Shigehide. Siebold recorded how he and the former lord of Satsuma had discussed plants, animals, the Dutch names of

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[129] Titsingh and F. Lequin (eds.), *The Private Correspondence of Kutsuki Masatsuna and Isaac Titsingh, 1785-1807: Compiled in Celebration of the Friendship between Kutsuki Masatsuna and Isaac Titsingh, Fukuchiyama, November 1992* (Amsterdam: Gieben, 1992).
[130] Titsingh references shogun Tokugawa Ienari (1773-1841), who was married to Shigehide's daughter Shigehime. Titsingh and Lequin (eds.), *The Private Correspondence of Kutsuki Masatsuna and Isaac Titsingh, 1785-1807,* p. 18.
[131] Ibid.
[132] Ibid.
[133] Ibid., p. 38.
[134] Ibid., p. 51.
[135] H. Plutschow, *Philipp Franz Von Siebold and the Opening of Japan* (Folkestone: Global Oriental, 2007), p. 3.

birds and insects, and astronomy.[136] Since both had a particular interest in natural science and the recording of flora and fauna, it is likely their conversations were dominated by these subjects. In what manner the conversations with Von Siebold influenced Shigehide is unclear, but their shared interest did have an impact on why and how Shigehide would influence *rangaku.*

3.2.2 The Legacy of Shimazu Shigehide

Shimazu Shigehide's interest in natural sciences influenced which projects he sponsored and what institutions he started. His philosophy was that many areas of study could only be comprehended by those who have an understanding of the study of nature.[137] Shigehide loved the study of nature, *honzōgaku.*[138] To him, economic success and the welfare of people was tied to the understanding of nature. Next to *honzōgaku,* Shigehide believed western learning was crucial for an understanding of the workings of plants and animals. The lord of Satsuma, therefore, sponsored many works on many different subjects within the study of nature. This was not merely a private enterprise. As Shigehide believed the study of, for example, agriculture was vital for the welfare of his people he believed these publications were of public interest.[139]

In what ways Shimazus Shigehide influenced *rangaku* is apparent from his collections and accomplishments. The lord had a large book collection, both in Satsuma and in Edo. His library in Satsuma was one of the largest collections in Tokugawa Japan, comparable to the Rakusaido library of Matsura Seizan (1760-1841), lord of the Hirado prefecture. These libraries contained Japanese, Chinese and Western books. Shimazu Shigehide kept his Dutch books in his Edo collection, where he met with scholars and interpreters.[140] From the correspondence between Isaac Titsingh and Kutsuki Masatsuna, it is clear that Titsingh believed he could rely on the help from the lord of Satsuma. His many sponsorships and support of those interested in *rangaku* make it clear that Shimazu Shigehide shared his wealth and knowledge with others. It is therefore likely that Shigehide made his collection available to other scholars, as was often done by those who were able to collect books.

Next to the sponsorship of scholars and interpreters, Shigehide also created new places for scientific research. He is responsible for the establishment of an observatory and medicinal garden

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[136] Marcon, "Nature as Accumulation Strategy", p. 287.
[137] Ibid., p. 285.
[138] Ibid.
[139] Ibid., pp. 286-288.
[140] Jackson, *Network of Knowledge,* p. 129 and 172, note 62.

in his prefecture, which could contribute to the study of astronomy and medicine. The observatory was built in 1779 at the astronomical school of Meijikan. There the interpreter Matsumura Genkō, who had also worked for Matsura Seizan in Hirado, was ordered by Shigehide to study astronomy and the calendar.[141] Another way the lord contributed to Japanese scholarship was by writing himself. He wrote three works, the first being a manuscript on birds with their Japanese, Chinese and Dutch names.[142] He also wrote *Shitsumon honzo* (Inquiry on botany) and *Nanzan zokugoko* (Treatise on colloquialisms at Nanzan), Nanzan being a mountain in the Kii region with many Buddhist temples.[143]

It is clear that the success of the lord of Satsuma in his studies and support of other scholars within *rangaku* was dependent on his economic and social capital. Shigehide was an avid collector of western books, as is clear from the collection mentioned above. In order to acquire these Dutch books he relied on his status, wealth and relations with the Dutch VOC-officials. Because of his social and political position and friendship with important VOC-officials, the lord of Satsuma was able to make personal requests at Nagasaki. His name is frequently found in the *eisen* (demands) the VOC-personnel recorded from important Japanese figures, such as the mayor or head interpreter. These documents contain lists of objects requested by the Japanese which the Dutch would bring with them on their next trip back to Japan. Shigehide's requests were being recorded as those of the 'Landsheer van Satsuma' (lord of Satsuma). His requests in the demands of the year 1771 include Dodonaeus' *Cruydt-boeck,* books on "land, sea and animals of all kinds", and life animals such as a peacock and hunting dogs.[144] The next year he requested another book on animals and birds, a book which described sea animals, and a copy of the *D'Amboynsche Rariteitenkamer* (The Ambonese Curiosity Room, 1705).[145] *D'Amboynsche Rariteitenkamer* was an expensive Dutch work containing descriptions on the zoology, botany and minerals of Ambon,

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[141]Goodman, *Japan and the Dutch 1600-1853,* p. 157; C.R. Joby, "The Dutch in Seventeenth-Century Japan: A Social History", *Dutch Crossing*, 42, no. 2 (2018), p. 11.
[142] "41. 鳥名便覧", National Archives of Japan via <http://www.archives.go.jp/exhibition/digital/daimyou/contents/41.html> (23 April 2021).
[143]Goodman, *Japan and the Dutch 1600-1853,* p. 158 and 263, note 19.
[144]Het Geheugen/Het Nationaal Archief, Japanse eisen, 1376, Eis van de landsheer, rentemeester en oppercommissaris, p. 4, via <https://geheugen.delpher.nl/nl/geheugen/view/eis-landsheer-rentemeester-oppercommissaris?query=&facets%5BcollectionStringNL%5D%5B%5D=Japanse+eisen&page=1&maxperpage=36&period=1700%2C1817&coll=ngvn&sortfield=date&identifier=NA01%3A00006001832> (5 October 2020).
[145]Het Geheugen/Het Nationaal Archief, Japanse eisen, 1377, Eis van de landsheeren het college, p. 3, via <https://geheugen.delpher.nl/nl/geheugen/view/eis-landsheer-college?query=&facets%5BcollectionStringNL%5D%5B%5D=Japanse+eisen&page=2&maxperpage=36&period=1700%2C1817&coll=ngvn&sortfield=date&identifier=NA01%3A00006001837> (5 October 2020).

one of the Moluccan islands in the Indonesian archipelago.[146] The German author, Georg Everhard Rumphius, had spent a large part of his life on Ambon, studying its rich flora and fauna.[147] Of course, as a scholar of *honzōgaku*, this book was of great interest to Shimazu Shigehide.

As much remains unclear, it is difficult to determine to what degree the lord of Satsuma influenced scholarship and *rangaku* in Tokugawa Japan. Since we do not know how and by whom the requested books from Shigehide were used, it is unclear how these Dutch works contributed to Japanese astronomy and scholarship in general. Another factor which may have been the result of Shigehide's efforts within the field of *rangaku,* is the interest in Dutch science of his son Kuroda Narihiro (1811-1887). Kuroda, lord of Fukuoka, carried on his father's legacy in medicine by establishing a hospital and medical school. Next to this, he was interested in western chemistry, as he established smelting works, a reverberatory furnace, and a chemistry laboratory.[148] Just like his father, Kuroda Narihiro ordered scholars who were more knowledgeable than he was to write books on several topics, one of them *Shin'u shoshiki* by Abe Ryuhei which was on the oppression of native Americans by the Europeans.[149] *Shin'u shoshiki* is an example of the development of scholarship and *rangaku* in nineteenth-century Japan, as Ryuhei uses more than twenty different categories of Western books in his work and refers to a large amount of sources, similar to modern day scientific writing. Ryuhei's *Shin'u shoshiki* shows the increased availability of western books and knowledge, while Kuroda Narihiro is an example of the ongoing support the lords gave and the acceleration of the development in *rangaku*. Whether Shimazu Shigehide had foreseen this development and used his economic and social capital to support it, is unclear. However, the lord of Satsuma is an interesting example of those who were interested in all things Dutch and the significance of the social and economic capital of lords in the pursuit of western books and knowledge.

3.3 Shiba Kōkan (1747-1818)

Another interesting representative of the *rangaku* movement in the late eighteenth and early

[146] LULDC, East Asia Vision, 22519, "Book illustration: various shells. From 'D'Amboynsche Rariteitenkamer' (Amsterdam, 1705), a description of botanical, zoological and mineral specimens from the Indies, by the German biologist Georg Everhard Rumphius", scanned from 日蘭交流のかけ橋: *Exhibition 'Bridge between Japan and the Netherlands: Through the Eyes of the "Oranda-Tsūji" or the Japanese Interpreters of Dutch'* (Kobe: Kobe City Museum, 1998), p. 98, pl. 151b, <http://hdl.handle.net/1887.1/item:1581707> (5 October 2020).
[147] Rijksmuseum.nl, "*D'Amboinsche rariteitkamer*", <https://www.rijksmuseum.nl/nl/collectie/NG-724> (5 October 2020).
[148] Goodman, *Japan and the Dutch 1600-1853,* p. 170.
[149] Ibid.

nineteenth century is the well known artist Shiba Kōkan (1747-1818). Shiba was born in Edo and became a painter and engraver. Originally trained in a Japanese and Chinese painting style, he began to study western oil painting and Dutch copperplate-etching techniques and from 1780 created Japanese landscapes in a western style (see figure 1 and 2).[150] Three years later he made his first etching, a technique he had learned by studying a Dutch encyclopedia, despite not being trained in the Dutch language.[151]

Figure 1: Tinted copperplate etching of Mt. Fuji. Source: Digital Collections Leiden.[152]

Figure 2: Oil painting of Shinagawa with a Chinese poem. Source: Digital Collections Leiden.[153]

Driven by his interest in Dutch painting and western science and art in general, Shiba embarked on a journey on foot to Nagasaki in 1788. He kept a journal which he would later publish as *Saiyū nikki* (*Journal of a Visit to the West*).[154] According to Goodman, Shiba was most interested in western art as a means to understand the truths of nature. *Saiyū nikki* was not only a travelogue, it

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[150] Goodman, *Japan and the Dutch 1600-1853,* p. 102.
[151] JapanKnowledge, "Shiba Kōkan", <https://japanknowledge-com.ezproxy.leidenuniv.nl:2443/lib/display/?lid=10800FA002706> (2 October 2020); Goodman, *Japan and the Dutch 1600-1853,* p. 102.
[152] LULDC, East Asia Vision, 20150, "Copperplate etching, tinted: view of mount Fuji seen from Yabe (in present-day Shizuoka Prefecture). A reverse image view, for use in a viewing box with mirror device; cf. Shiba Kôkan's sketch of the same view in his 'Saiy¿ENikki' manuscript (*). By Shiba Kôkan, shortly after 1799". Scanned from M. Hosono, *Nagasaki Prints and Early Copperplates* (Tokyo: Kodansha, 1978), p. 81, pl. 56, <http://hdl.handle.net/1887.1/item:1578966> (6 October 2020).
[153] LULDC, East Asia Vision, 2168, "Oil painting: a view of the anchorage at Shinagawa with fishing boats, by Shiba Kōkan. Signed 'Kôkan Shiba Shun' and, in western script, "Si Kookan". Inscribed with a laudatory poem in Chinese by 'The Hermit Fūō, aged 76 ("sai")'; his identity is uncertain. No collection indicated". Scanned from Naruse Fujio et al., *Nihon bijutsu ega zenshū*, Vol. 25 (Tokyo: Shūeisha, 1977), pl. 15, <http://hdl.handle.net/1887.1/item:1581154> (6 October 2020).
[154] JapanKnowledge, "Shiba Kōkan" <https://japanknowledge-com.ezproxy.leidenuniv.nl:2443/lib/display/?lid=10800FA002706> (2 October 2020); LULDC, East Asia Vision, 20152, "Two pages from Shiba Kôkan's travelogue 'Saiyû nikki', 'Journal of a Visit to the West': view of mount Fuji seen from Yabe (in present-day Shizuoka Prefecture), manuscript dated 1815. The same view in reverse is seen on Shiba Kôkan's handcoloured etching in the Homma Art Museum (acc. 20150)". Scanned from Naruse Fujio et al., *Nihon bijutsu ega zenshū*, Vol. 25 (Tokyo: Shūeisha, 1977), p. 87, pl. 66, <http://hdl.handle.net/1887.1/item:1578940> (6 October 2020).

was also an account of Shiba's appreciation for western art and science. As his interest gradually shifted from western painting to theories on the universe, he began writing several books on western astronomy.[155] Throughout his lifetime Shiba Kōkan was an active member of the *rangaku* community by his studies, travels, writing and contacts with other Japanese scholars.

3.3.1 A Journey Towards Understanding the Truths of Nature

Although Shiba Kōkan is most famous for his western style artwork, the Japanese artist produced a number of contributions to *rangaku,* including texts on western astronomy. He wrote on theories of the universe, navigation and celestial globes.[156] Shiba differs from other scholars within *rangaku,* not only because of his background in art, but also because of his limited knowledge on the Dutch language. Unlike Motoki Ryōei and Shimazu Shigehide, Shiba Kōkan was not able to read or write in Dutch. He relied completely on translations made by, for example, the Nagasaki interpreters. He made use of Motoki's translation of George Adams' work and it is known he often copied texts by previous Japanese scholars and interpreters while adding a few of his own comments.[157]

Shiba gained access to translations and western books through his social contacts, just like other scholars active within *rangaku.* He had relations with other scholars such as the aforementioned Hiraga Gennai, mathematician Honda Toshiaki (1743-1820), *rangaku* scholar Ōtsuki Gentaku (1757-1827) and Dutch VOC-officials such as Isaac Titsingh.[158] Like Motoki, Shiba was allowed access to Hiraga Gennai's collection of foreign books. It is known Shiba borrowed Gennai's copies of Jonstonus's book on natural history the *Historia Insectorum Generalis, ofte Algemeene Verhandeling van de Bloedeloose Dierkens* (Amsterdam, 1669) by Jan Swammerdam.[159] Honda Toshiaki was a mathematician and personal friend of Shiba Kōkan. Although it is not known if the two exchanged books, they probably exchanged ideas on heliocentricity. Honda wrote in his *Seiiki monogatari* (Tales of the West, 1798) that heliocentricity was well known in Europe and that no one in Japan and China were willing to accept the theory as the truth. He then stated Europe had gone through a similar process, where thanks to "generations of progressively-minded men" everyone was eventually converted to heliocentrism.[160] The friendship between Honda and Shiba possibly stimulated the two to work on astronomy. Honda

[155] Goodman, *Japan and the Dutch 1600-1853,* p. 103.
[156] Ibid.
[157] Ibid., pp. 102-103.
[158] Jackson, *Network of Knowledge*, pp. 123, 127 and 171-172; Goodman, *Japan and the Dutch 1600-1853,* p. 111.
[159] Jackson, *Network of Knowledge*, p. 172, note 51.
[160] Goodman, *Japan and the Dutch 1600-1853,* p. 112.

had also studied with Ōtsuki Gentaku, who supplied books to Shiba Kōkan.[161] Ōtsuki Gentaku was an important figure within *rangaku* because of his contributions to Dutch studies and the study of medicine. He established the first *rangaku* school in Edo and translated Dutch books into Japanese.[162] Ōtsuki contributed to Shiba Kōkan's *Chikyū zenzu ryakusetsu* (A summary of the complete world atlas; 1793) by giving Shiba his copy of the *Nieuwe atlas, Inhoudende de Vier Gedeeltens der Waereld* (New atlas, showing the four corners of the world) published in Amsterdam by Johannes Covens and Cornelis Mortier, which Ōtsuki had purchased from a Dutch physician in 1787. Shiba had used the *Nieuwe atlas* as a reference for his own book on world maps.[163]

The Dutch VOC *opperhoofd* Isaac Titsingh was also of great assistance to Shiba's studies. He supplied Shiba with several Dutch books. They had met in 1780 in Edo, where the artist lived.[164] Like other scholars, Shiba Kōkan travelled to Nagasaki at great cost to acquire Dutch books. In Nagasaki, he received three books which were most likely sent by Isaac Titsingh: *Tractaet in wat manieren men op root koper snijden ofte etzen zal* (Tract on how to carve copper-plate etchings) by Abraham Bosse, which was translated from the French original and published by Jacob van Meurs in Amsterdam in 1662; *Groot Schilderboek* (The great book of painting) by Gerard de Lairesse, published in 1707 in Amsterdam; *Kunst Schilddren* [sic] *Boek* (Art painters book).[165] From these titles it can be concluded Isaac Titsingh contributed greatly to Shiba's study of Dutch paintings and techniques. Again, Shiba was indebted to his Japanese colleague Ōtsuki Gentaku, who helped him translate Bosse's *Tractaet in wat manieren men op root koper snijden ofte etzen zal* and Egbert Buys's *Nieuw en volkomen woordenboek van konsten en weetenschappen* (Amsterdam 1769-1778).[166] Either of these books was important to Shiba Kōkan as he was interested in etching techniques.

In order to gain access to Dutch books, knowledge and to establish relations with

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[161] Ibid., pp. 111-112.
[162] Jackson, *Network of Knowledge*, p. 28.
[163] Ibid., p. 127.
[164] Ibid., p. 171, note 33.
[165] Ibid., p. 123 and 171, note 24.
Jackson notes the title of the art painters book as *Kunst Schilddren Boek,* which cannot be traced back (especially in view of the possible typo in *Schilddren*). The book Shiba received is therefore unknown, but it could be *Het Schilder-boeck* by Karel van Mander (1604), see <https://www.dbnl.org/tekst/mand001schi01_01/mand001schi01_01_0001.php> (28 May 2021).
[166] Boxer, *Jan Compagnie in Japan, 1600-1850,* p. 111; M. Forrer, "From Optical Prints to Ukie to Ukiyoe. The Adoption and Adaptation of Western Linear Perspective in Japan", in Thomas Da Costa Kaufmann and Michael North (eds.), *Mediating Netherlandish Art and Material Culture in Asia* (Amsterdam: Amsterdam University Press, 2018), p. 245.
Possibly "Boisu", as Shiba calls the author, does not refer to Bosse but to Buys, which would mean Ōtsuki only translated the latter title for Shiba Kōkan.

VOC-officials and other Japanese scholars and interpreters, Shiba Kōkan travelled the country. In 1788 he went to Nagasaki, where he would have picked up the books from Isaac Titsingh. As Titsingh had left the country four years prior, it would not have been possible for the two men to meet at Nagasaki. However, there is a possibility Titsingh sent the books to Nagasaki after arriving at his new post or perhaps Shiba had met him previously in Nagasaki and left this journey unrecorded.[167] Shiba Kokan had the extraordinary opportunity to visit Deshima in 1788 and meet with the Dutch VOC-personnel. The visit to the island must have been an interesting experience, as Shiba was able to ask questions directly to the Dutch about all the subjects he was interested in. [168] However, as explained in the previous chapter, whether or not these questions could be answered by the Dutch would have depended greatly on their knowledge and willingness to share information. As Jackson states: "Luck, ingenuity, and hard work in establishing social ties with the Dutch and other key individuals was a must for any scholar hoping to obtain Dutch books."[169] Shiba did well when it came to establishing these relations, as with the help of the aforementioned luck, ingenuity and hard work he eventually gained access to the Dutch, their books and translations.

By combining his studies of Dutch books, art and the Dutch themselves, Shiba Kōkan was able to write several works on astronomy, art and Japanese scholarship in general. Although he was most famous for his art and commentary on western art versus Chinese and Japanese art, he also made interesting contributions to Japanese astronomy as the popularizer of Copernicus.

3.3.2 Popularization of Copernicus

Whereas Motoki Ryōei is often credited as the one who introduced Copernicanism into Japan, Shiba Kōkan is recognized by many as the popularizer of the theory. It is often argued that Shiba's influence on the Japanese study of astronomy was greater than Motoki's, as Shiba's books were more widely available and read by the Japanese people.[170] To understand Shiba Kōkan's influence on the study of western astronomy in Japan, it is important to understand the history of the books that Shiba and Motoki wrote.

Motoki Ryōei's manuscripts contained a limited introduction to heliocentrism and

[167] Boxer, *Jan Compagnie in Japan, 1600-1850,* p. 112.
[168] C. Göttler and M. Mochizuki, *The Nomadic Object* (Leiden/Boston: E.J. Brill, 2017), pp. 230-231.
[169] Jackson, *Network of Knowledge*, p. 123.
[170] Goodman, *Japan and the Dutch 1600-1853,* pp. 102-103; Nakayama, *The Orientation of Science and Technology*, p. 12.

Copernicanism, but Shiba Kōkans books do not necessarily improve on this part. Shiba and Motoki seem equally knowledgeable in astronomy and thus the differences between their works lie elsewhere. Motoki's manuscripts were never published during his lifetime and although they were spread widely among Japanese government officials and scholars, his work was not well read among a wider Japanese audience. As a result, even after the introduction of Copernicanism into Japan, not many Japanese knew about the theories of the European astronomer.[171]

In contrast, Shiba Kōkans books did get published and were widely available throughout Japan. This availability eventually resulted into the popularization of Copernican theory. Because of the audience Shiba Kōkan's books on astronomy had, it has been argued by Goodman that his role within the study of western astronomy in Japan was that of "an extremely important transmitter of Western technical knowledge to Japan".[172] Shiba had the opportunity to publish his work freely, because he didn't have an official position. Compared to Motoki, who was affiliated with the *bakufu* and was not able to write freely about his views, Shiba could express his own ideas. Next to this, as he was regarded as an artist and not necessarily as a (official) scholar, he also remained free from the requirements other scholars had to meet. Therefore, Shiba's work contains more speculation than the translations of interpreters and the work of scholars who were officially hired.[173]

In his work *Chikyū zenzu ryakusetsu* (A summary of the complete world atlas; 1793) Shiba Kōkan briefly mentions heliocentrism, but does not elaborate on the theory. However, in his other books *Oranda tensetsu* (a Dutch explanation of heaven; 1795), *Oranda tsuhaku* (Dutch navigation; 1805), *Kopperu tenmon zukai* (Copernican astronomy illustrated; 1805) and *Chitengi ryakuzukai* (A brief illustrated explanation of the celestial globe; 1808) he tries to explain heliocentrism and clearly connects this system to Copernicus for the first time in Japanese history.[174] The most important works for the popularization of Copernicus are *Chikyū zenzu ryakusetsu, Oranda tensetsu* and *Kopperu tenmon zukai.* Through these works, his art and journal Shiba acknowledged western achievements and superiority in astronomy and art, but he never apologized for the traditional knowledge of Japan, which had its origin in Sino-Japanese relations. Shiba Kōkan incorporated western astronomical concepts into his own idea of cosmology in the same way as he

[171] Goodman, *Japan and the Dutch 1600-1853,* p. 98.
[172] Ibid., p. 102.
[173] Ibid., p. 103.
[174] Ibid.; Nakayama, " On the Introduction of the Heliocentric System into Japan", p. 12.

had incorporated western techniques into his paintings.[175]

Since he was an artist, one would think Shiba was able to contribute to Japanese astronomy by creating many drawings of the solar system or astronomical instruments. Although he did incorporate many illustrations in his book, even in this aspect, Motoki Ryōei had been ahead of him. In *Shinsei tenchi nikyū yōhōki*, Motoki copied the illustrations from *Gronden der Starrenkunde* and provided translations of the text within the illustrations. For example, the illustrations in figure 3 are exact copies, from the diagram to the text. The outer ring of the illustration in figure 3 says "Kring der vaste Starren" (circle of fixed stars) , and Motoki's version says 「恒星天」(sphere of fixed stars).

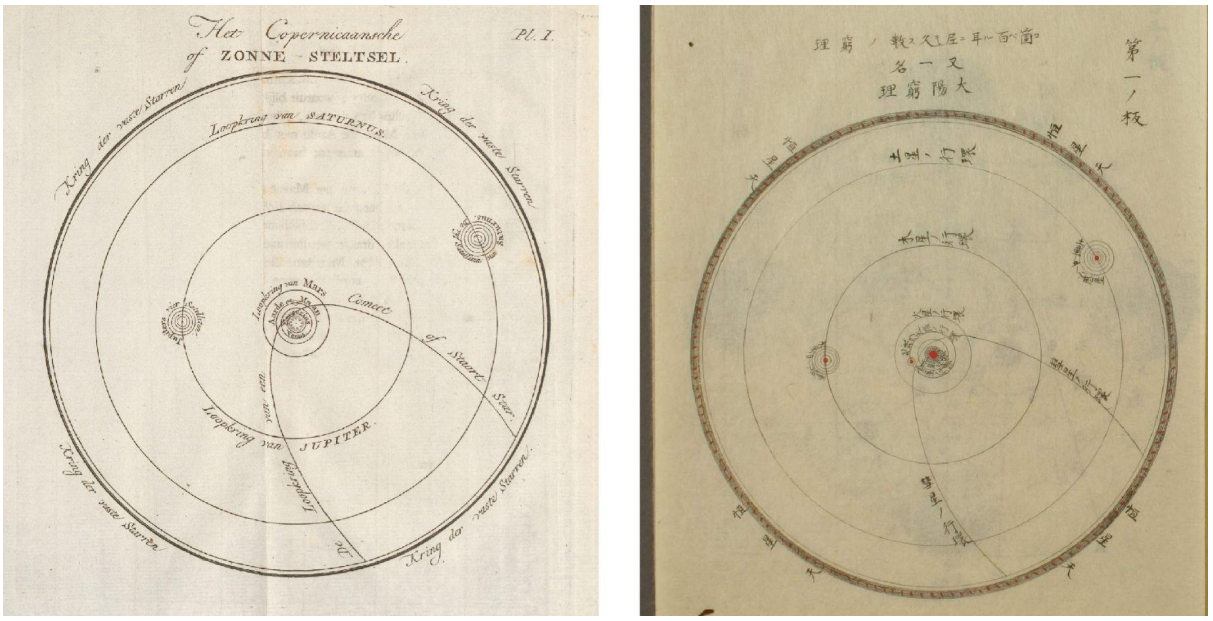

Figure 3: An example of how Motoki copied the western illustrations. Left: Book illustration in *Gronden der Starrenkunde, gelegd in het Zonnestelsel* (1770) published by Kornelis van Tongerlo in Amsterdam. Source: ETH-Bibliothek Zürich.[176] Right: A diagram in *Shinsei tenchi nikyū yōhōki* by Motoki Ryōei. Source: Japanese & Chinese Classics Database of the Waseda University Library.[177]

[175] Nakayama, "Diffusion of Copernicanism in Japan", in *The Orientation of Science and Technology: A Japanese View* (Folkestone: Global Oriental, 2009), p. 76.
[176] J. Ploos van Amstel, *Gronden der Starrenkunde, Gelegd in het Zonnestelzel Bevatlijk Gemaakt : In eene Beschrijving van 't Maaksel en Gebruik der Nieuwe Hemel- en Aard-Globen ...* (Amsterdam: Kornels van Tongerlo, 1770), via ETH-Bibliothek Zürich, Rar 4382, <https://www.e-rara.ch/zut/content/zoom/562480> (25 April 2021).
[177] Waseda University Library, Japanese & Chinese Classics Database, ニ05 02335, 新制天地二球用法記. 1-7,[附録] / [G.アダムス] [原著] ; [J.プロース] [蘭訳] ; 本木仁太夫 [訳], vol. 7, p. 56, <https://www.wul.waseda.ac.jp/kotenseki/html/ni05/ni05_02335/index.html>, <https://archive.wul.waseda.ac.jp/kosho/ni05/ni05_02335/ni05_02335_0007/ni05_02335_0007_p0056.jpg> (6 October 2020).

Although Shiba may not have been the first *rangaku* scholars to use (these) illustrations, he used them in a very different way than Motoki had done. Motoki had placed his illustrations in the beginning and end of *Shinsei tenchi nikyū yōhōki.* Shiba, however, used a very different lay-out for *Oranda tensetsu.* In this manuscript, he placed illustrations between his text, similar to a modern scientific book. This required some planning, but the result is impressive (see figure 4).

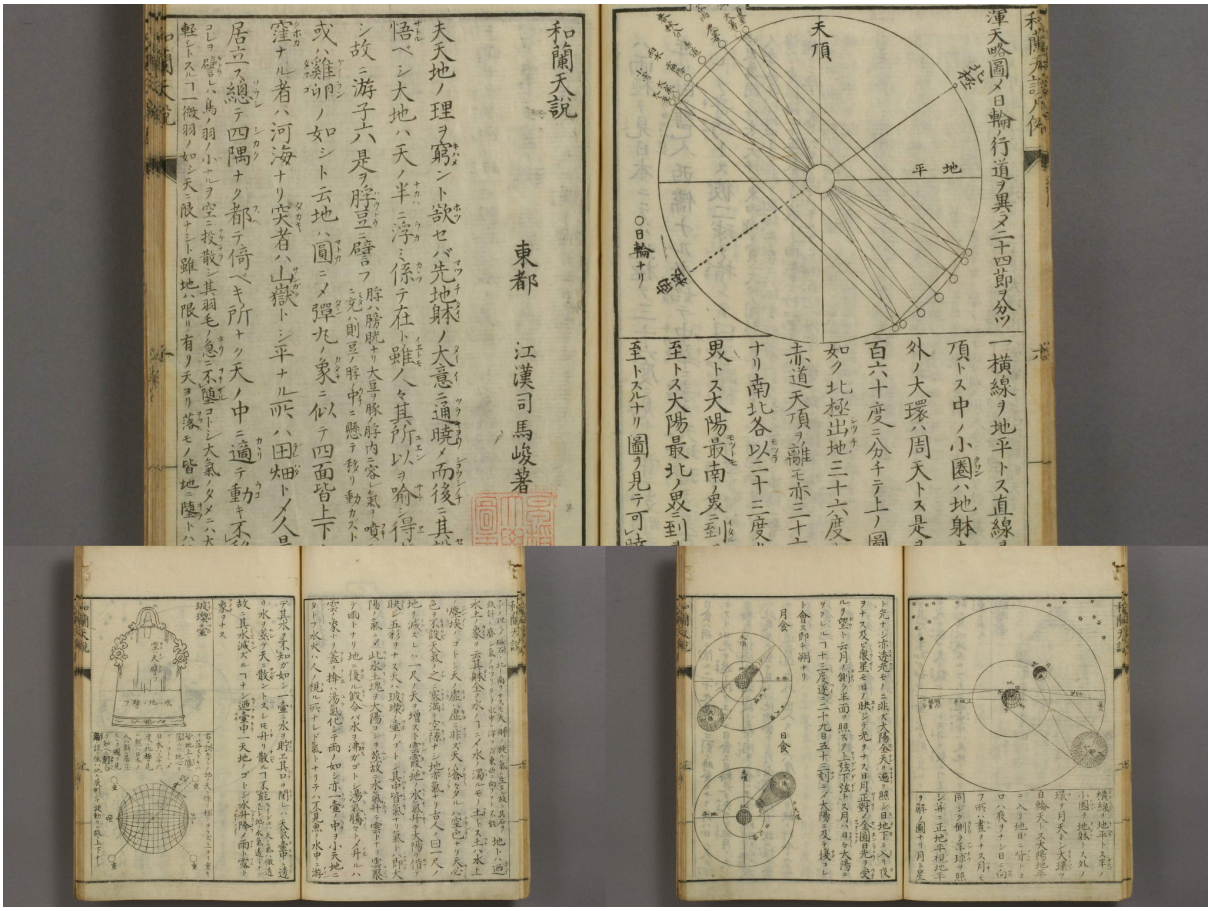

Figure 4: Page 10 to 12 of *Oranda tensetsu* (1795) by Shiba Kōkan. Source: Japanese & Chinese Classics Database of the Waseda University Library.[178]

It is known Shiba used Japanese translations of western sources for his own work, such as the translations of Motoki Ryōei. Since Motoki's illustrations can be traced back to *Gronden der Starrenkunde* and the original by Adams, it seemed the above illustrations by Shiba would have to appear in those as well. However, the exact illustrations from *Oranda tensetsu* could not be found in *Gronden der Starrenkunde, Tweevoudigh Onderwys* or *Filosofische Onderwijzer* and it is therefore

[178] Waseda University Library, Japanese & Chinese Classics Database, ニ05 00777, 和蘭天説 / 司馬江漢 著, pp. 10-12, <https://www.wul.waseda.ac.jp/kotenseki/html/ni05/ni05_00777/index.html> (25 April 2021).

unclear where Shiba had seen these illustrations before.

Shiba's later work called *Kopperu tenmon zukai* did feature illustrations similar to the western originals. For example, in *Kopperu* Shiba inserted a schematic illustration of how the earth moves from Libra to Capricorn, Aries and Cancer back to Libra, as described by George Adams (see figure 5). This same illustration can be found in Adams' third edition of *A Treatise Describing and Explaining the Construction and Use of New Celestial and Terrestrial Globes* (1772).

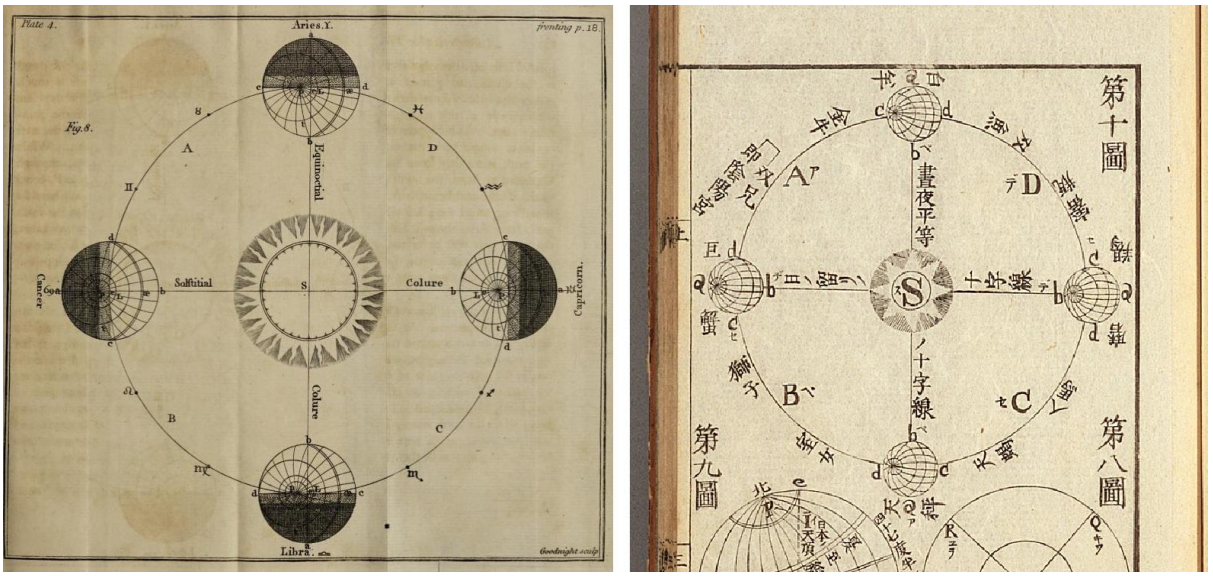

Figure 5: A comparison of Adams and Shiba. Left: The movement of the earth in *A Treatise Describing and Explaining the Construction and Use of New Celestial and Terrestrial Globes* (1772) by George Adams via Internet Archive.[179] Right: The same illustration by Shiba Kokan in *Kopperu tenmon zukkai* (1808) via National Diet Library Japan.[180]

Despite his impressive illustrations, it is apparent Shiba lacked knowledge not only on astronomy, but on European history in general. The title of *Kopperu tenmon zukai* has the word *Kopperu* to indicate the involvement of Copernicus. *Kopperu*, however, originally referred to Johannes Kepler, a sixteenth-century German astronomer, and was not used for the study of Copernicus or his theories in any other work but Shiba's.[181] Perhaps such a mistake could have been avoided if Shiba

[179] G. Adams, *A Treatise Describing the Construction, and Explaining the Use of New Celestial and Terrestrial globes: Designed to Illustrate in the Most Easy and Natural Manner, the Phoenomena of the Earth and Heavens, and to Shew the Correspondence of the Two Spheres: With a Great Variety of Astronomical and Geographical Problems* (Londen: 1772), via
Internet Archive, QB 66 .A3 1772, p. 18, <https://archive.org/details/treatisedescribi00geor/page/18/mode/2up> (25 April 2021).
[180] National Diet Library Japan, Japan-Netherlands Exchange in the Edo Period, 101-184, *Kopperu tenmon zukkai*, 2, <https://www.ndl.go.jp/nichiran/e/data/R/114/114-002r.html> (25 April 2021).
[181] Nakayama, "Diffusion of Copernicanism in Japan", p. 84.

had better knowledge of the Dutch language and more access to the editions of the European astronomers. This further proves the importance of interpreters and lords such as Motoki and Shimazu, who were able to provide scholars such as Shiba Kōkan access to (translated) western books. Without the existence of Motoki's work, Shiba would not have been able to write books such as *Chikyū zenzu ryakusetsu* or *Oranda tensetsu.* However, without Shiba's contributions the theories Motoki translated would have not been read by a wider Japanese audience.

3.3.3 Shiba's Significance in Japanese Scholarship

Not only did Shiba Kōkan promote the study of astronomy in Japan, his work also impacted scholarship in Japan in various ways. Shiba was on his way towards, in the words of Goodman, "scientific objectivity in an era of restricted intellectual activity," and in the process managed to "attack" Confucianism and somehow escape judgement from the *bakufu* for his actions.[182] As mentioned before, Shiba wrote several works on a variety different subjects. Some of these works contain a form of social commentary, or showed Shiba's interest in comparing European and Japanese culture and society. For example, Shiba commented on how Europeans regarded aristocrats (the samurai class) and businessmen (the merchant class, which was considered the lowest) in Japan as equals, which Goodman argues to be an example of Shiba commenting on Japanese inequality.[183] He was also known for criticizing those who did not accept the heliocentric theory and those who studied Buddhism.[184]

During the Tokugawa period, Buddhism lost its popularity as the leading intellectual movement and Confucianism took its place. Confucianism was, as mentioned before, the official ideology of the Tokugawa government and its ideas and theories had a great impact on scholarship in Japan. However, there were some Japanese Buddhists who tried to restore the Buddhism's popularity as an intellectual movement during this period.[185] Shiba Kōkan's writings show he was opposed to these Buddhists and considered Buddhism as a false doctrine.[186] Those who believed in Buddhism tended to have ideas contrary to those of the west in general and astronomy in particular, and were therefore met with disapproval by Shiba Kōkan.[187]

Although Confucianists had relatively little trouble accepting heliocentrism, with the

[182] Goodman, *Japan and the Dutch 1600-1853,* pp. 102-104.
[183] Ibid., p. 103.
[184] Ibid., pp. 193-194.
[185] Nakayama, "On the Introduction of the Heliocentric System into Japan", pp. 12-13.
[186] Goodman, *Japan and the Dutch 1600-1853,* p. 194.
[187] Ibid.

exception of those who were fiercely against western influence in general, Shiba still uttered criticism of Confucianism through his writings on astronomy.[188] According to him, Confucianism had lost its essence and needed to be revised. Comparing those who did not accept heliocentrism to crawling ants, Shiba (perhaps in some cases unintentionally) attacked Confucianism.[189] These attacks would certainly provoke a reaction from the Tokugawa government, if they had come from someone who they deemed to be of great importance. Shiba Kōkan was no such person. Because of his low social status as an artist instead of a highly regarded scholar or Tokugawa official, Shiba was regarded as a loner and an eccentric which may explain why the government did not take action against Shiba and the publication of his writings.[190]

Shiba's commentaries on scholarship and science in Japan ranged from criticizing Buddhism to claiming Japan and China had no scientific tradition. According to him, Confucianists in their reliance on Chinese classics stood in the way of reaching scientific objectivity and knowing the truth of nature.[191] In contrast to a scholar such as Andō Shōeki (1703-1762), who wrote on the calendar and made sense of astronomy by using concepts from Chinese ideology such as *qi* and Heaven to explain natural disasters, Shiba believed he followed a path of true science instead of ideology by studying western science.[192] During the eighteenth century Japanese scholars who studied nature lacked interest in researching the laws of nature and were more focused on social and ethical issues, which contradicted Shiba's view.[193] Japanese scholars under the influence of Confucianism studied from a "moralistic, anthropocentric and often anthropomorphic" perspective, resulting in little attention for what we now know as exact sciences, such as mathematics and physics.[194] As Dutch studies of astronomy contained far more diagrams, formulas and mathematics than Buddhist or Confucian works on the heavens, Shiba regarded the Dutch science as superior and tried to push for a shift towards this approach.

Thus, Shiba relied heavily on earlier work such as that of Motoki and he was not able to interpret the original western texts by himself due to his lack of understanding the Dutch language.

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[188] Nakayama, "On the Introduction of the Heliocentric System into Japan", p. 14.
[189] Goodman, *Japan and the Dutch 1600-1853,* pp. 102 and 193.
[190] Ibid., p. 104.
[191] Ibid., p. 193.
[192] See W. Masaki, "Ideological Construction and Books in Early Modern Japan: Political Sense, Cosmology and World Views" in M. Hayek and A. Horiuchi (eds.), *Listen, Copy, Read: Popular Learning in Early Modern Japan* (Leiden/Boston: E.J. Brill, 2014) , p. 56.
[193] S. Nakayama, "Eighteenth-Century Science: Japan," in *The Orientation of Science and Technology* (Folkestone: Global Oriental, 2009), p. 345.
[194] Ibid.

[195] Next to this, Shiba had a low status and was regarded poorly within the scholarly community of Japan. These issues may have limited his influence within the scholarly community itself, but it did allow him to write more critical commentaries which would later become more popular among the Japanese people.[196] Therefore, his impact on Japanese astronomical scholarship should not be overlooked.

3.4 Shizuki Tadao (1760-1806)

A shift in the study of astronomy in Japan occurred after the generation of Motoki Ryōei. At the end of the eighteenth century an important interpreter began producing influential manuscripts based on the work of Motoki and Dutch books. Shizuki Tadao (1760-1806) is a now very well known Japanese ex-interpreter who wrote on astronomy in the Tokugawa period. He worked for a period as an interpreter and teacher of Dutch in Nagasaki, but is best known for his influential manuscripts on astronomy, based on Johan Lulof's *Inleidinge tot de waare natuur- en sterrekunde* (Introduction to true physics and astronomy, 1741). Shizuki was born as Nakano Ryuho before being adopted into the Shizuki family. The Shizuki's were a long line of Nagasaki interpreters and Shizuki Tadao became the interpreter of the eighth generation.[197] However, due to his poor health he decided to leave his position as an interpreter and began studying subjects of his own interest.[198]

Although many scholars state that Shizuki was a pupil of Motoki Ryōei, according to Horiuchi there is no evidence to back up this statement. However, it is clear that the interests of both men overlap and that Shizuki used Motoki's translations for his own work.[199] Shizuki already worked on translations on natural philosophy and cosmology during his time as an interpreter. After Shizuki stepped down as an interpreter, he worked on introducing Newton's theory into Japan.[200] According to Nakayama, Shizuki's work was so important for the Japanese study of astronomy and natural science that his work remained unsurpassed until the mid-nineteenth century.[201]

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[195] Goodman, *Japan and the Dutch 1600-1853,* pp. 102-103.
[196] Ibid.
[197] Ibid., p. 104.
[198] Nakayama, "Diffusion of Copernicanism in Japan", p. 74.
[199] Horiuchi, "When Science Develops outside State Patronage", p. 163.
[200] Nakayama, "Diffusion of Copernicanism in Japan", p. 74.
[201] Ibid., p. 76.

3.4.1 Newton in Japan

Before Shizuki Tadao translated *Inleidinge tot de waare natuur- en sterrekunde,* he had asked his friend and colleague Ōtsuki Gentaku if he was able to send him books on astronomy and physics in Chinese or any western language. This might be how he acquired Lulofs's book.[202] It is not clear if and with whom in the VOC Shizuki had contact, so it is likely he got access to Dutch books through his network of Japanese connections during his time as an interpreter and teacher of Dutch. *Inleidinge tot de waare natuur- en sterrekunde* was based on the Latin *Introductiones ad veram physicam et veram astronomiam* by the English scholar John Keill (1671-1721), published in London in 1725. It was first translated into Dutch by Johan Lulofs (1711-1768), who added some of his own comments to the Dutch edition. This edition, printed in Leiden by Jan and Hermanus Verbeek, was probably used by Shizuki Tadao. Johan Lulofs was a professor in astronomy and mathematics at Leiden University and his work can be categorized as belonging to the philosophy of physico-theology. Followers of physico-theology sought to honor God by studying nature (and thus his creations). Next to this, they aimed to prove science was compatible with the biblical narrative.[203]

Because of the strict *bakufu* who prohibited the propagation of Christianity in Japan, directly translating this physico-theological work was a challenge. Shizuki omitted most of the theological content in Lulofs's work, but not all, as he translated it with the help of familiar Buddhist concepts and terms. The translation would take Shizuki more than twenty years. He made three drafts between 1782 and 1784 with information on mechanics, astronomy and the law of gravitation. During a period of some fifteen years, these drafts were revised and developed into a monograph entitled *Rekishō shinsho* (New treatise on calendrical phenomena), which circulated as three handwritten volumes between 1798 and 1802. Just as Lulofs had added comments to John Keill's work, Shizuki added a large amount of comments, ideas and concepts of his own into *Rekishō shinsho.*[204] Thus, he did not necessarily translate the *Inleidinge tot de waare natuur- en sterrekunde*, but rather used the Dutch book as a basis of his thinking on astronomy. Shizuki was very interested in the controversy aroused by Newtonian theory in Europe and therefore chose to use Lulofs' work, even though it was already a bit outdated. His personal interest drew him to the

[202] Jackson, *Network of Knowledge*, p. 123.
[203] A. Blair and K. von Greyerz, *Physico-Theology: Religion and Science in Europe, 1650-1750* (Baltimore: Johns Hopkins University Press, 2020), p. 1.
[204] Nakayama, "Diffusion of Copernicanism in Japan", pp. 74-75.

work of Newton instead of that of Copernicus, as he was intrigued by Newton's theories on motion. Thanks to his interest, which did not directly contradict Chinese theories in the way Copernicanism did, Shizuki was able to translate and explain modern western thought by quoting Buddhist and Taoist thinkers.[205]

3.4.2 Influence and Limitations

Similar to Motoki, Shizuki's work was read in manuscript form and was not published during his time. This of course limited Shizuki's reach outside of the *rangaku* community, but his work was gradually picked up by other Japanese scientific thinkers and popularizers.[206] In contrast to Motoki, Shizuki's writings addressed the issue of identifying Copernicus with more caution. Nakayama even believes that Shizuki displayed a more scholarly attitude towards this issue than Motoki Ryoei had done.[207]

An important aspect to keep in mind is that it was never Shizuki's intention to spread or popularize Copernican theories. According to Nakayama, he intended to "reconcile modern Western theory with traditional Chinese views", as can be seen from his attempts to explain Newton's principles through Buddhist concepts.[208] Shizuki's explanation was still very limited, despite his skills in Dutch and his, compared to Motoki's, improved understanding of astronomical concepts. According to Yulia Frumer, those who read Shizuki's translation on Newton could take away two points: (1) There was an important man named Newton, and (2) his theory on motion significantly impacted western astronomical thinking. Similar to Lulofs's theological comments, Keill's discussions on physics and celestial motions were omitted. However, as Keill's work was crucial to an understanding of the theories Shizuki had translated from Dutch, the Japanese edition was quite difficult to comprehend.[209]

Shizuki probably omitted some of John Keill's work due to a lack of knowledge. Even though he understood mathematical formulas and some theories, he struggled with understanding Keill's physics. As he was a pioneer in this field in Japan, there were no colleagues with whom Shizuki could discuss his findings in order to gain a better understanding of the European theories. Next to this, the Dutch VOC-officials were no experts in physics either and could not help him

[205] Ibid., p. 75.
[206] Ibid., pp. 75-76.
[207] Ibid., p. 84.
[208] Ibid., p. 75.
[209] Frumer, "Before Words", p. 176.

understand or translate the complex theories from Keill's and Lulofs's book.[210] In one of his prefaces Shizuki apologized for his comments on his translation of this scientific text and admits that his knowledge on astronomy is limited and that he had added his comments because he feared his translation alone would "hinder the reader from grasping the full meaning of the original text,".[211]Again, a Japanese translator and *rangaku* scholar was severely limited in his work by a lack of knowledge, a lack of (Dutch) experts in Japan and, in a way, because of the strong influence of Confucianism on Japanese society.

3.5 Yoshio Nankō (1787-1843)

The last figure who should be discussed here is Yoshio Nankō (1787-1843). Yoshio was the grandson of the famous head interpreter Yoshio Kōsaku, with whom Motoki Ryōei had worked for in Nagasaki. Yoshio Nankō was born in Nagasaki into a family of interpreters which dates back to 1641. From an early age he was interested in the natural sciences, but because of his family tradition he became a translator of Dutch. He was taught Dutch by his uncle Yoshio Gonnosuke (1785-1831), a very talented interpreter who acted as Yoshio Nankō's guardian throughout his youth.[212] Compared to his colleagues Motoki Ryoei and Shizuki Tadao, Yoshio was a more versatile and mobile scholar. He also differs from the others because he was active during a new chapter in the history of *rangaku*.

3.5.1 From Interpreter to Explosives Expert

Like many other interpreters and scholars before him, Yoshio went on a trip from Nagasaki to Edo. However, he did not merely return to Nagasaki to resume his duties as an interpreter. Along the way he met important people, such as medical professional Asai Teian with whom he developed a friendship.[213] He held several positions throughout his lifetime: interpreter, teacher and physician. [214] In 1814 he established a Dutch school in Osaka, three years later he became the family physician of the Owari clan. Asai Teian took Yoshio under his wing and introduced him to the Owari family,

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[210] Goodman, *Japan and the Dutch 1600-1853,* p. 105.
[211] Horiuchi, "When Science Develops outside State Patronage", p. 160.
[212] G. Thirion, "L'Ensei Kanshō Zusetsu (1823) de Yoshio Nankō: Une Fenêtre sur la Science Classique", *Annals of Science*, 69, no. 1 (2012), p. 109; Goodman, *Japan and the Dutch 1600-1853,* p. 161.
[213] Thirion, "L'Ensei Kanshō Zusetsu (1823) de Yoshio Nankō", p. 109; Soutairoku, "浅井貞庵", <http://soutairoku.com/01_soutai/01-1_a/03-1_sa/asai_tonan_owari/asai_teian.html> (13 October 2020).
[214] Soutairoku, "吉雄常三", <http://soutairoku.com/01_soutai/08-5_yo/03-2_si/yosio_jouzou/yosio_jouzou.html> (13 October 2020).

who ruled over the domain which is now called Nagoya. This was a very important position, as the Owari clan was part of the ruling Tokugawa family and thus were powerful people.[215] Next to working as a fief physician, Yoshio established a translation office, studied chemistry from Dutch books and used this knowledge in experimenting with explosives. This last interest proved fatal: in 1843 he died as a result of an explosion in 1843.[216]

Together with his pupils Ueda Nakatoshi (上田仲敏, 1809-1853) and Ito Keisuke (1803-1901), Yoshio Nankō made Nagoya the centre of *rangaku* and the spread of western knowledge in central Honshu.[217] As mentioned before, Yoshio had studied under his uncle Gonnosuke who was a talented interpreter and student of several European languages. He practiced French with Hendrik Doeff and English with Jan Cock Blomhoff. Gonnosuke was an excellent student and teacher with far more developed skills in translating Dutch than Yoshio Nankō. Since Gonnosuke was hardly two years older, it is likely he was introduced to Dutch and *rangaku* much earlier than Nankō.[218] Gonnosuke was also a former pupil of Shizuki Tadao, whose work would influence Yoshio Nankō's own work later in his life. For example, his most important work in the field of astronomy was largely based on Dutch sources and Shizuki Tadao's work and resembled modern scholarly work in the sense that he referenced multiple sources.[219]

Yoshio's first work on astronomy was finished in 1822. *Seisetsi kanshōkyō* (Treatise on astronomy according to the theories of the West) was a short *orihon* (manuscript folded as an accordion) on astronomy which consisted of only some two thousand characters. The next year, he worked on his most important contribution to the study of Japanese astronomy: *Rigaku nyushiki ensei kanshō zusetsu* (Illustrated explanation of scientific deductions from Western meteorological observations), which was based on the work of Shizuki Tadao, Johannes Florentius Martinet and Yoshio's own teachings as transcribed by his pupil Kusano Yōjun. Kusano Yōjun collected the teachings of his master in a manuscript and left for Osaka to get it printed in book form in 1821. Sadly Kusano died before the book came into existence. Yoshio subsequently took over the project of his pupil and realized the printed publication of *Rigaku nyushiki ensei kanshō zusetsu* in the following years.[220]

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[215] Thirion, "L'Ensei Kanshō Zusetsu (1823) De Yoshio Nankō", p. 109.
[216] JapanKnowledge, "吉雄俊蔵", <https://japanknowledge-com.ezproxy.leidenuniv.nl:2443/lib/display/?lid=1001000233224> (13 October 2020); Goodman, *Japan and the Dutch 1600-1853,* p. 163.
[217] Goodman, *Japan and the Dutch 1600-1853,* p. 163.
[218] Thirion, "L'Ensei Kanshō Zusetsu (1823) de Yoshio Nankō", p. 109.
[219] Goodman, *Japan and the Dutch 1600-1853,* p. 162.
[220] Thirion, "L'Ensei Kanshō Zusetsu (1823) de Yoshio Nankō", p. 110.

3.5.2 Copernicus and Confucius

Like Shizuki Tadao, Yoshio Nankō combined Confucianism and Copernicanism in his astronomical writings. In his *Rigaku nyushiki ensei kanshō zusetsu*, published in three parts in 1823, 1826 and 1828, Yoshio gave an overview of astronomy. The first part consisted of a text on Tycho Brahe, Copernicus and diagrams of the astronomical system of Ptolemy.[221] The second part dealt with the sun, planets, earth, moon, eclipses and more. The third part was concerned with the individual planets, fixed stars, constellations and comets. In an appendix Yoshio also addresses Shizuki's work from *Rekisho shinsho*, in which Shizuki had tried to combine Newtonian principles and classical Chinese knowledge. In comparison to Shizuki, who was quite apologetic about his preference for western theory, Yoshio had the freedom and information to unapologetically state his positive attitude towards western astronomy.[222]

According to Thirion, Yoshio referred (either directly or indirectly) to many European scholars next to Shizuki, such as aforementioned Jan Floris Martinet, Benjamin Martin, William Whiston, Robert Hooke, Galilei, William Molyneux, Gassendi, Descartes, Francesco Fontana, Cassini, James Short, Charles Bonnet, Christiaan Huygens, Lalande, Philippe Lahire, Halley, Ulugh Beg, Giovanni Battista Riccioli, Hevelius, John Flamsteed, James Bradley, and Regiomontanus. Since Yoshio did not provide the titles of the books of these authors, it is possible he used books that already referred to these authors, instead of their originals. Which sources are used, then, is unclear.[223]

However, Yoshio Nankō based parts of his *Ensei kanshō zusetsu* on Johannes Florentius Martinet's *Katechismus der natuur* (Catechism of nature), published originally in Amsterdam in four parts between 1777 to 1779. Later editions were more condensed and were aimed at the education of children, as the title *Kleine katechismus der natuur voor kinderen* (Small catechism of nature for children) indicates. Johannes Florentius Martinet wrote these books in a dialogue-style, which made its content easier to comprehend for those who had studied Dutch in Japan.[224] To write his book in dialogue-style was a conscious decision of Marinet, as he had experience in teaching children and youths. Having studied theology in Leiden, Martinet worked in Zutphen as a

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[221] This might be an indication of the influence of Motoki Ryoei's translation of Blaeu's *Tweevoudigh Onderwijs* on Yoshio, since he made use of Ptolemy whose theory was discussed in the first half of *Tweevoudigh Onderwijs.*
[222] Goodman, *Japan and the Dutch 1600-1853,* p. 162.
[223] Thirion, "L'Ensei Kanshō Zusetsu (1823) de Yoshio Nankō", p. 113.
[224] T. Yoshida, *The Rangaku of Shizuki Tadao: The Introduction of Western Science in Tokugawa Japan*, PhD Dissertation Princeton University, 1974, pp. 305-306.

protestant minister and teacher. In his *Kleine katechismus* he made children familiar with the study of nature as a means to know God.[225]

How and when *Katechismus der natuur*, or perhaps also the *Kleine catechismus* came into Yoshio's hands is not clear. The book is registered in the *eisen,* but only after Yoshio's time. For example, in the *Eis van de opperburgermeester* (Demand of the mayor) of 1828 two copies of Martinet's "Natuurkunde or Catecismus [sic] der Natuur" were requested by the Japanese.[226] It seems surprising that a title as *Katechismus der natuur,* which obviously has theological content, could be so openly requested by the Japanese. However, from the last half of the eighteenth century onwards, the ban on western books was not completely operative and scholars and interpreters had more freedom in choosing their subjects and sources.[227] This, however, did not mean Japanese scholars started enthusiastically started studying western religion. According to Shinichi Nagao, some *rangaku* figures such as Shizuki Tadao and Yoshio Nankō had no doubt that Confucianism was superior to western philosophy and religion, but did not shy away from acknowledging the superiority of some of the western scientific theories. It seems that Yoshio took a similar approach as Shizuki when translating Dutch physico-theological studies.[228] Indeed the content of *Ensei kanshō zusetsu* seems to be based more on Martin's *Filosofische Onderwijzer,* which Motoki used as well, than on Martinet's work. Thirion argues this could be explained by the lack of solid astronomical explanation in Martinet's work, as it was written for Christian children.[229]

3.5.3 Towards Modernity

As a Japanese interpreter and *rangaku* scholar, Yoshio Nankō was witness to a change in Japanese scholarship during the time of *Ensei kanshō zusetsu*, from merely translating individual texts to quoting and contrasting multiple western sources and scholars. Yoshio's book differs in that respect from traditional Sino-Japanese scholarship and is more like modern scholarly work. For example, Yoshio can be regarded as a modern scholar because he quotes many different sources and went beyond merely introducing western astronomy to the Japanese public. Of course, this is also true

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[225] Yoshida, "The Rangaku of Shizuki Tadeo", p. 306. Whether Japanese scholars used this children's edition is unclear.
[226] Het Geheugen/Het Nationaal Archief, Japanse eisen, 1420, Eis van de opperburgermeester, p. 31, via <https://geheugen.delpher.nl/nl/geheugen/view?query=&facets%5BcollectionStringNL%5D%5B%5D=Japanse+eisen&page=5&maxperpage=36&coll=ngvn&identifier=NA01%3A00006000830&resultsidentifier=NA01%3A00006000823> (14 October 2020).
[227] Nakayama, "On the Introduction of the Heliocentric System into Japan", p. 11.
[228] S. Nagao, *Politics and Society in Scottish Thought* (St. Andrews, 2012), via <https://books.google.nl/books/about/Politics_and_Society_in_Scottish_Thought.html?id=IJm7BAAAQBAJ&redir_esc=y> (13 October 2020).
[229] Thirion, "L'Ensei Kanshō Zusetsu (1823) de Yoshio Nankō", p. 112.

for *Ensei kanshō zusetsu* because that book is based on Kusano's lecture notes. However, an important difference between the work of Yoshio and that of other interpreters, such as Motoki, is that Yoshio tried to introduce, explain and defend the western theories instead of merely translating the Dutch text.[230] His work is written in such a manner that the reader can comprehend the complex concepts of the western theories that are presented. Moreover, the illustrations offer additional support to the reader. Many of them are based upon Martin's book while others are similar to the illustrations of Shiba Kōkan.[231]

Ensei kanshō zusetsu was founded upon Shizuki Tadao's work, but in some ways Yoshio's manuscript also surpasses the work of Shizuki. According to Thirion, *Ensei kanshō zusetsu* became the most popular work for referencing astronomy in the mid nineteenth century. Thanks to the the circulation of *Ensei kanshō zusetsu*, terms and concepts were introducted into common Japanese vocabulary and expressions coined by Shizuki Tadao, such as "movement of the earth", eventually appeared in the textbooks of modern Japanese schools.[232] The preface of the book, written by Yoshio's pupil Kusano, and the appendix written by Yoshio himself, reflect the ideas Shizuki Tadao had discussed in *Rekisho shinsho.* Through this text, Yoshio and Kusano popularized Shizuki's work which had not received much circulation and attention among the Japanese public during his lifetime.[233] Yoshio's contribution to the study of Japanese astronomy should therefore not be underestimated. The Nagasaki interpreter who became a Nagoya explosives expert popularized Shizuki Tadao's discussion of Copernican and Newtonian theories and with the help of his pupil Kusano spread these ideas among the Japanese public for the first time. His impact lasted well into the Meiji period, during which schoolbooks used the terminology of Shizuki Tadao that Yoshio and Kusano had helped to distribute.

[230] Ibid., p 114.
[231] Ibid.
[232] Ibid., p. 111. Thirion is referring to "*chidō no setsu* (the theory of the earth's motion)", see Nakayama, "Diffusion of Copernicanism in Japan, p. 85.
[233] Ibid., pp. 117-119.

Conclusion

This thesis presents an image of the exchange and usage of Dutch books by Japanese scholars and officials who were connected to the study of astronomy during the eighteenth-, and nineteenth centuries. This image is based on the general history of the knowledge exchange between the Netherlands and Japan during the Tokugawa period, and the scholarly histories of a few key figures: Motoki Ryōei, Shimazu Shigehide, Shiba Kōkan, Shizuki Tadao and Yoshio Nankō. By researching the interactions between Japanese scholars and VOC-officials and the key figures' interactions with Dutch books and their influence on Japanese scholarship, it became clear Dutch books were indeed very important. However, the amount of influence the Dutch books and that of their Japanese translators had, was dependent on many factors, which can be divided into three categories: factors that are related to (1) the countries, (2) the Dutch-Japanese relation, and (3) the recipients of the Dutch books.

First of all, the Netherlands and Japan had certain characteristics during the eighteenth-, and nineteenth century which positively and negatively influenced the knowledge exchange. For example, Japan's mandatory travel positively influenced the exchange between Japanese scholars and Dutch officials and among Japanese scholars themselves. Because of mandatory travel, think of the *hofreis* the VOC-officials had to make, Japanese scholars and officials had the opportunity to meet interpreters and VOC-officials and exchange knowledge - thus, establishing a social knowledge network throughout Japan. Japan's newfound wealth also positively influenced *rangaku* scholarship during the eighteenth,- and nineteenth centuries. Due to the improved economics, Japanese lords and the *bakufu* were able to invest in Japanese scholarship and purchase western books from the Dutch. Lastly, due to the flourishing Dutch book market, the VOC-officials had a variety of scholarly books to offer to the Japanese.

Second, by applying social network theories, it was found that some of the characteristics of the relationship between Japan and the Netherlands also influenced the exchange. A positive characteristic was the fact that the Dutch and Japanese maintained a successful relationship despite the lack of trust. Trust was initially established because the VOC-officials could prove the *bakufu* they had no intend of spreading the Christian faith. Later, the *bakufu* made sure trust became unnecessary by creating rules for the Dutch and the Dutch had their own financial motives. It is proven relationships like these can successfully continue in the absence of trust, provided that there

are other assurances, which was the case between the Netherlands and Japan. Although this was ideal for a trade relationship, the knowledge exchange remained limited due to the focus on trade, the language barrier, and the limited interest from the Dutch.

Third, the introduction of western science to Japan moved slowly, despite the availability of Dutch books through the VOC. Japanese who were interested in studying western science were held back due to political actions that limited free international communication. Whether this was the ban on western books due to their possible religious content or the forbidden interaction between commoners and VOC-officials. Those who did get a chance to translate western books struggled with the language barrier or their lack of scholarly training. Therefore, they were unable to accurately translate the Dutch books and spread western science through Japan. Then there were those Japanese scholars who were not entirely comfortable with introducing western theories as they contradicted their own ideological perspectives.[234]

In order to avoid making hasty conclusions, this thesis was written bearing in mind Goody's arguments on eurocentrism. Therefore, the influence of Dutch books was critically analyzed. One can argue Dutch books and VOC-officials had influence on Japanese scholarship and the introduction of western science in Japan, but it is important to be aware of the characteristics of the countries, their relationship and the recipients of the Dutch books. These characteristics not only show the opportunities for spreading western knowledge, but also the limitations. In order to have a nuanced view of the impact of Dutch astronomy books on Japan, these limitations also need to be considered. In conclusion, the flourishing book market in the Netherlands and the well established trade relationship with Japan enabled the Dutch to make an impact on Japanese scholarship. However, this impact was limited due to the factors discussed above and arguing the Dutch stirred Japan towards modernity would be highly exaggerating.

Another important addition to this research was the use of sociological theories to make sense of the historical relation between the Netherlands and Japan. By applying these theories, the research focused not only on books, but also the people surrounding the books. Book are not objects that simply exist — they are printed, exchanged, read, rewritten, and banned by humans. It is therefore interesting to not only consider information from the books, but also information on

[234] As Wim Boot wrote: "The important point is not what Europe had on offer, but what the Japanese intellectual elite was willing and able to pick up, conditioned and constrained as the intellectuals were by the knowledge system in which they had been raised.". W.J. Boot, "The Transfer of Learning: The Import of Chinese and Dutch Books in Tokugawa Japan" in E. Groenendijk, C. Viallé, J.L. Blussé (eds.) *Canton and Nagasaki Compared, 1730-1830. Dutch, Chinese, Japanese Relations. Transactions.* (Leiden: IGEER, 2009), p. 201.

the people surrounding these books, their usage and exchange. Next to this, the book historical research was also expanded by not only investigating the western and Japanese books, but also the demands, letters, and illustrations. These sources also reflected the relationship between the books and those who read them.

Although it was possible to present several interesting factors that played part in the influence of Dutch astronomical books on rangaku, there is still much to discover. Due to limited access to (primary) sources, the scope of this researched remained quite small. Moreover, it was not always possible to dig deeper and find more detailed information about the books and the people that handled them, which could have led to interesting results and more definitive conclusions. During the historical research on Dutch astronomical books in Japan, rangaku, the printing and spread of books in Japan and the Netherlands during the eighteenth-, and nineteenth centuries, a great amount of interesting information came forward. It would take thousands of hours to investigate these subjects, and it would be very valuable to do so. This current research could be expanded and enriched by, for example, more historical research into the printing, publishing and circulation of books in Japan in general or the lives of the VOC-officials on Deshima. There are many more subjects like these that could fill in the gaps found during this research.

Future research could focus on these niche subjects. However, the most important development would be to have more research that focuses on non-western countries and compares these histories with western book histories. Not to come to the conclusion that the West is superior in its literary development, but to create a growing awareness for the (sometimes similar) development of literacy in other countries, and in this case even scholarly development, and how the history of books is a history of people.

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Leiden University Libraries Digital Collections, East Asia Vision, 21681, "Oil painting: a view of the anchorage at Shinagawa with fishing boats, by Shiba Kōkan. Signed "Kôkan Shiba Shun" and, in western script, "Si Kookan". Inscribed with a laudatory poem in Chinese by "The Hermit Fūō, aged 76 ("sai")"; his identity is uncertain. No collection indicated" scanned from Naruse Fujio et al., *Nihon bijutsu ega zenshū*, Vol. 25 (Tokyo: Shūeisha, 1977), pl. 15, <http://hdl.handle.net/1887.1/item:1581154> (6 October 2020).
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